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VOLUME 6. No. 2 FEBRUARY 1954

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Vol. 6. No. 2 — FEBRUARY 1954

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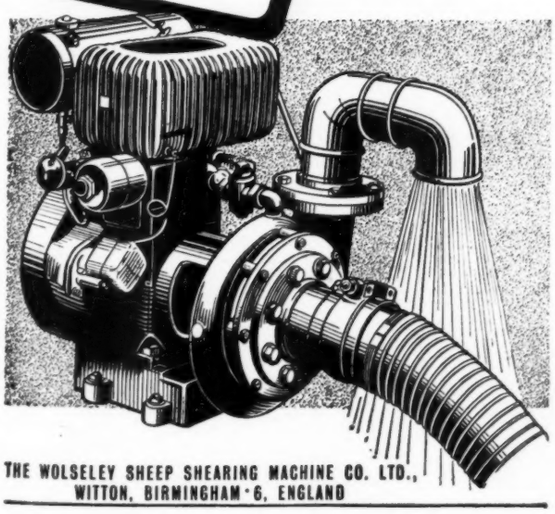

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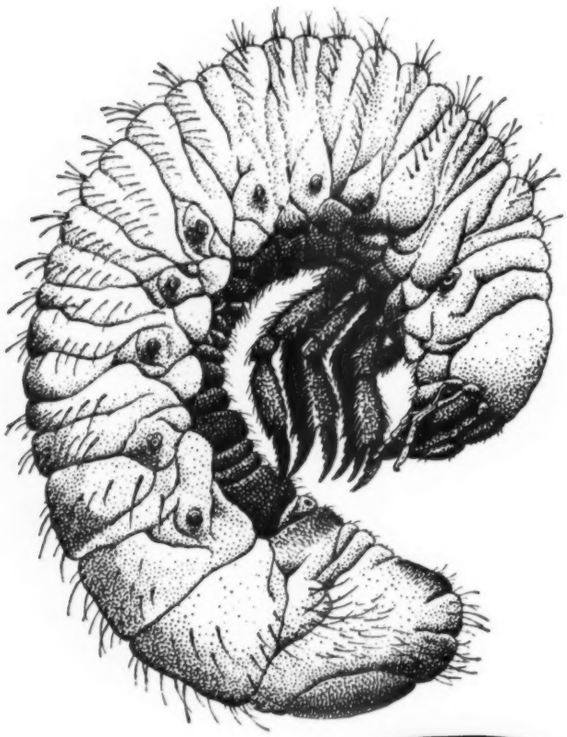
White Grub (*Phyllophaga and Melolontha spp.*)



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Editorial Comment

Agricultural prices in Britain

THERE have been some flutterings and misgivings in agricultural circles in Great Britain concerning the future of the British farming industry in the light of the policy of the British Government. These misgivings have been heightened and intensified by the absence until recently of any exact definition of their intentions by the Government itself and by the darkling hints of terrible times in store for British agriculture which have been so liberally promulgated by the Socialist opposition party as part of their plan of political propaganda. An example is the recent party political broadcast on December 12 by Mr. T. Williams, Minister for Agriculture in the late Socialist Government.

Matters have to an extent been clarified in a recent speech by Mr. G. R. H. Nugent, Joint Parliamentary Secretary for Agriculture, speaking on behalf of the Minister at a meeting at Bury St. Edmunds on November 27 last and also in a broadcast by the Minister, Sir Thomas Dugdale, on December 15.

A point on which anxieties had been freely expressed is whether the Government, in implementing its policy of a return to freer marketing conditions, would be able to ensure that the provisions of the 1947 Agriculture Act, in so far as these assure a fair return to farmers for their produce, would be fulfilled. In his speech, Mr. Nugent pointed out that the publication of the Government's White Paper on marketing of agricultural produce should have resolved certain major anxieties on this score. It was the Government's intention to maintain a fair return to producers by a system of guaranteed prices. These will be announced after the usual February price review, in accordance with previous usage, with the difference that in future deficiency payments or support prices would take the place of fixed prices for produce purchased by the Ministry of Food.

In addition, the Government proposes to give producers the opportunity of participating in the marketing of their produce through the medium of the producer marketing boards, to which it is proposed to give back some of the powers which they exercised before the war. The Government has also provided during the past two years for the restoration of ploughing grants, calf subsidies and fertiliser subsidies.

He pointed out that under the existing Government, and following the price reviews of 1951 and 1952, the estimated income of the agricultural industry in Great Britain has increased by 10% to 20%. Simultaneously, agricultural production has increased appreciably during the past two years and there are indications that this tendency is being maintained. He referred to fears that large surpluses in world food stocks in America might lead to low world prices and a demand for cheap food at any cost which might destroy the guarantees to domestic agriculture, and stressed the determination of the present Government to do everything possible to expand home food production and to develop a standard of price structure and marketing favourable to agricultural prosperity.

In concluding his speech, he pointed out that a system of continued State purchase in a period of falling world prices could not reduce the cost to the Exchequer of maintaining fair returns to farmers, while to maintain rationing and State purchase merely as a means of helping farmers involved placing a great strain on policy. All of which seems sound British commonsense.

World wheat supplies

THE withdrawal of Great Britain from the International Wheat Agreement last August has been followed by a fall in wheat prices which has tended to become intensified. In July last free wheat was down to $2.00 a bushel as compared with $2.32 in November 1952, while today free wheat and International Agreement wheat are both selling at around $1.89.

It is as yet too early to decide the full effect of Britain's action on world prices; obviously the transfer of Britain, which is the largest wheat importer, to the free market is bound to have an effect on prices, since it means that as Britain is now to seek her import requirements in the free market the scope of that market is automatically greatly enlarged. At the same time, there are a number of other factors which influence the situation, the full effect of which cannot be fully gauged as yet.

Among these must be the magnitude of available supplies of wheat in North America, largely the result of the favourable seasons experienced last year. In both the U.S.A. and Canada the total supplies this season are much higher than in the previous year. It is estimated that in the United States by the beginning of next season the final carry-over may have risen to 775 million bushels, while in Canada the carry-over may well exceed 500 million bushels. There are, in fact, some authorities who hold that the drop in the price of free wheat is largely due to the effect of the American carry-over stocks, and that the effect of the British withdrawal is so far without influence on the price. This seems to be supported by the fact that latterly Britain has been much less active in world grain markets, since the large stocks held by the Ministry of Food are being disposed of as the result of the decontrol of grain supplies by the Government. In fact, it can be argued that these two factors are entirely responsible for the price recession.

One thing seems clear: that for the present there is an absolute world surplus of wheat and, following precedent, there seems no reason to suppose that this will not exercise an influence on world wheat prices. The outlook for the future seems uncertain. Recent FAO estimates suggest that by 1956-57 there is likely to be a decline in world wheat production from the recent high levels as a result of reduction of acreages and decline of yields below the recent high levels. Meantime, receding prices will probably continue until demand and supply come once more into balance.

The South Coast flies

IN England of recent weeks quite a flutter has been aroused by the appearance of swarms of black flies, which have proved a source of annoyance to inhabitants of South Coast towns. The flies themselves are named *Coelopa frigida*, they breed on decaying organic matter and have apparently developed high resistance to insecticides of the chlorinated hydrocarbon types. They have sprung into prominence recently as the result of the casting up on the foreshores of the English South Coast during recent equinoctial storms of large quantities of seaweed, which, lying on the beaches and decomposing, formed an admirable pabalum for the multiplication of the flies, which suddenly increased to formidable proportions.

So much attention did the matter attract that the insects actually became the subject of a question in the House of Commons by Mr. H. Johnson, who apparently was under the impression that these insects were a menace to food production. In his reply Sir Thomas Dugdale pointed out that there was no evidence that this particular fly was a menace to food production; there appeared, however, to have been some confusion between this and another fly, *Megaselia plurispinosa*, which infests mushroom houses and has caused damage by feeding on mushroom mycelium. The latter is much the more dangerous and is engaging the attention of the Ministry at present in an effort to exterminate it. The confusion between the two flies is perhaps not surprising, since after all, to the uninitiated, one fly can look very much like another.

Meantime, however, the epidemic of *Coelopa* bred from seaweed assumed such proportions that steps were taken to organise demonstrations at Brighton with fog applicators in an attempt to mitigate or cure the nuisance. A number of these were tried with, it is understood, promising results. The second demonstration was attended by the Rt. Hon. Harold Macmillan, Minister of Housing. On another page we reproduce some photographs taken by our staff photographer at these demonstrations.

A new chemical influence?

LATE last year a communication to *Nature* (W. G. Boll, **172,** 963) disclosed what may be yet another new chemical effect upon the natural events of plant growth. Like some other discoveries of this kind, this one emerged accidentally, or at any rate in the course of research work aimed at a different target. In experiments to determine the minimum time required for bromine water to sterilise the surfaces of tomato seeds, it was observed that the growth of the seed radicle was often stimulated by the bromine treatment. Further experiments to measure this effect of stimulation were at once designed and carried out, and the results now published leave little doubt that the effect is both consistent and significant. It is true that in these initial experiments the speedier growth of the radicle obtained did not increase either viability or rate of germination, but there are many kinds of seeds and it is by no means impossible that for some of them the stimulation of radicle growth may bring benefits of really practical value. After all, it is the growth of the radicle that starts the seed-into-plant story; it is the radicle that first pierces the seed coat and it is the radicle that first ventures abroad and later becomes the main root.

The differences in radicle development caused by half a minute's and two minutes' immersion of seed in bromine water are not small. The former treatment gave a radicle length after seven days of 67 mm. (average of 11 measurements); the longer treatment gave a length of 79.1 mm. (average of 11 measurements). In addition, the second treatment produced two extra laterals, and the length of the first lateral was 7 mm. greater. These results were obtained for seeds ' sown ' in a sterile medium; but similar results were given with seeds germinated on moist filter papers.

It is suggested that the influence of bromine may be attributable to a stimulus of vitamin synthesis in the seeds; in 1942, American workers found that calcium hypochlorite solution—which can be chemically regarded as chlorine water—affected the formation of major constituents of the vitamin B complex during germination. Radicle growth may normally be limited by the rate and balance of vitamin production in the germinating seed, and chlorine or bromine may be helpful because they increase the flow of vitamins.

These studies began at the University of Manchester, but are now being continued at the University of Texas by the same worker. They may remain fundamental and academic, with little hope of practical application, but they could equally well bring opportunities for improving the performances of normally difficult seed species.

Synthetic rice

WE have long been accustomed to the idea of manufactured synthetic substitutes replacing crop products; rubber, synthetic textile fibres, indigo and alizarin immediately spring to the mind as cases in point. Nevertheless, the news that in Japan of all places it is seriously proposed to introduce the manufacture of what has been termed synthetic rice comes as something of a shock.

On further enquiry, however, it transpires that by synthetic is meant, in this case, not, as one might imagine, production of a carbohydrate food by some complicated chemical reaction from mineral oil or from coal, but a product compounded of various combinations of wheat flour, potato flour and rice itself in powder form, to be used as what has been euphemistically termed an ' extender', which can be mixed with real rice in cooking and will not be eaten alone. It is stated that commercial production has already been begun on a small scale in Japan and is expanding.

Apparently, the idea was first conceived in Japan about 1940, when war was approaching and concern over food supplies was growing. Research continued rather desultorily during the war and with little success, which was not surprising seeing that in the absolute shortage of foodstuffs that prevailed increasingly in Japan during the war it was hardly necessary to cater for epicurean desires for a product that looked and tasted like rice.

After the war, however, efforts to produce a substitute which really resembled rice were intensified. As large supplies of sweet potatoes were available, a food that is not highly valued by the Japanese, in the first place attention

was centred on this crop. The result was, however, disappointing, as, although it was found possible to convert sweet potato meal into a granular product that resembled rice in the dry state, when it was cooked it crumbled and dissolved, while the taste did not even remotely resemble that of rice.

After this failure technicians in Japan turned to other materials and by the autumn of 1952 the National Food Research Institute, under the direction of Dr. Yosito Sakurai, managed to develop a product which, when it was cooked, sufficiently resembled rice in appearance, consistency and colour. The ingredients were wheat flour, starch from Irish potatoes, powdered rice and water. Various rates of compounding were tried: a common mixture now is 70% wheat flour, 20% potato flour and 10% powdered rice. The National Food Research Institute have estimated that mixtures of this sort in chemical composition and nutritional value approximate very closely to natural rice.

The future of this product seems to depend very largely on the relative market prices of rice itself and the materials from which the substitute is manufactured. Formerly, when rice was cheap and plentiful, there could be no future for it. Rice itself is one of the highest yielding cereals, but its production is labour consuming and involves arduous work. If the price cheapens as the result of extended cultivation and improved methods, there seems little prospect of the synthetic article succeeding, but if, on the other hand, it becomes and remains substantially cheaper than natural rice it may have some future, especially with lower income groups in Japan and other parts of Asia.

Agriculture and sanitation

THE public at large and even those who are directly interested in the problems of the technologically backward parts of the world and are well informed on many aspects of them are often insufficiently apprehensive of the importance of the impact of sanitation on agriculture. It is not always appreciated that, for example, it was the result of the discovery of the role of the mosquito as the vector of malaria and yellow fever that made possible the construction of the Panama Canal by the Americans after the costly failure of the earlier French effort as a result of endemic disease. Another example is the establishment of the plantation rubber industry in the Malay peninsula which was rendered possible by the application of anti-malarial prophylaxis.

Further point is given to this reflection by the fact that in China agricultural production has for centuries been based upon the extensive use of human excreta for manurial purposes. No doubt from the strictly utilitarian point of view, this is an admirable procedure, since it avoids the waste of plant nutrients and valuable soil constituents, but from the point of view of human health it is a major hazard and was responsible for a considerable fraction of the high death rate which prevailed in that country. Indeed, for centuries, China has been noted for the manner in which diseases of various descriptions flourished and of these it has been estimated that approximately 40% are faeces-borne. The position in this regard has recently been examined in a book with the title ' Health and Agriculture in China,' by Dr. J. C. Scott, published by Faber and Faber, and reviewed in a recent issue of *Nature* by Dr. Joseph Needham.

The outstanding problem is, of course, the means of treating excreta in such a way as to convert them into a non-pathogenic fertilising medium. This particular problem can be solved by composting them with waste vegetable material and earth. Dr. G. Scharff, of the medical service of Malaya, gave ample demonstration of the effectiveness of this method before the last war in Malaya and subsequently in some of the West African territories. In China, however, the difficulty exists that insufficient vegetable waste is available, partly because the dense population has led to the deforestation of vast areas as a result of the demand for fuel. The reafforestation of waste lands with quickly growing trees which will provide both fuel and also material for composting, as well as the planting up of roadsides and railway cuttings with vegetation are urgent matters. Another direction in which improvement could be effected would be the replacement of the use of faeces by artificial fertilisers when the latter become available.

Dr. Needham in his review refers to the fact that it is now the policy of the present government of China to discourage actively the age-old system of using excreta for manure, and records the fact that in the past year he was able to see personally the remarkable progress that has been made in the improvement of sanitary and public health measures in China. It cannot, however, be overlooked that the failure to make use of human excreta does represent a great waste of fertilising material, and it seems not unreasonable to imagine that in the near or distant future this will become recognised and attention will be turned to making use of this material by methods which will avoid the risks normally attendant on its use.

Purchase tax and textiles

FOR many months now a section of the British textile industry under the chairmanship of Sir Raymond Streat, Chairman of the Cotton Board, has been waging a campaign having for its object persuading the Chancellor of the Exchequer to abolish purchase tax on British textile materials manufactured for sale in this country.

Purchase tax has always weighed heavily on the textile industry in Great Britain and in consequence of representations made by the industry the so-called D scheme was introduced in 1952; this imposed a price level, called the D line, in respect of certain goods below which purchase tax would not be payable, while above it the incidence of the tax depended on the margin by which the price of the goods exceeded the D level. Obviously, this taxation fell most heavily on goods of the highest quality. At present the Government are urging the necessity for increasing the export trade in textiles and the main hope here lies in maintaining and enhancing the reputation of British textile goods of high quality. Here, however, the purchase tax operates most prejudicially, since it penalises quality goods in the home market. Accordingly, manufacturers work to a lower

price and quality level to avoid tax and without support in the home market it often becomes uneconomic to produce quality goods for export only; moreover, stocks of high quality textiles cannot be held in readiness for immediate delivery and the manufacture of long and economic ' runs ' of quality materials is largely precluded.

Nineteen industrial and textile organisations have combined to present the case for action in this regard, including representatives of the cotton, linen, silk, rayon and synthetic fibre industries and also the West Indian Sea Island cotton industry, which has been hardly hit by the tax, since the cotton produced there is of very high quality and can only be economically used in making high quality fabrics, which must come above the D line. The trade is not large, but in many small West Indian islands cotton growing provides the principal source of income.

In connection with this campaign, Sir Raymond Streat's committee recently staged in London a very effective exhibition showing conclusively how the purchase tax is damaging the textile industry and British export trade. They have also arranged discussions with groups of Members of Parliament of all political complexions.

It is generally admitted that purchase tax in itself is a thoroughly unsatisfactory impost. Introduced during the war as a measure to check excessive spending on luxury goods, thereby intensifying the war effort, it has become in the post-war period an effective agency for raising revenue for expenditure on the enormous programme of social and other services to which post-war governments stand committed. Let us hope that the Government may be able to see its way to providing the relief demanded in this particular case, which should certainly benefit export trade, and that the Chancellor of the Exchequer may also be able to resolve the revenue-raising problems which it involves.

Fertiliser application machines

DR. G. W. COOKE, of Rothamsted, whose work on the placement of fertiliser dressings is well known, recently read a paper in London to the Institution of British Agricultural Engineers on the subject of mechanical fertiliser distributors. This is one of those topics that, like the neglected wife, suffers mainly from being taken for granted. Innumerable plot and field tests tell us the increases in yield that may be expected from this and that rate of dressing, and Dr. Cooke's own papers among others have told us what additional gains we can hope for with many crops if dressings are placed in bands. But in all this it is far too casually assumed that the machines available to farmers will, in fact, apply commercial fertilisers uniformly over large fields and at the predetermined rates. This survey of the facts is timely.

It is clear that gravity-flow types of distributor are much less efficient than those in which the fertiliser flows horizontally and at a metered rate from the hopper, and most appliances now sold in the United Kingdom are of this latter kind. They suffer some tendency to variation in rate of emission from the effect of the weight or head of fertiliser in the hopper and from the effects of inclination due to ground contour irregularities, but both these causes of variation can to some extent be compensated by intelligent operation. The physical condition of the fertiliser is by no means an unimportant factor and Dr. Cooke's tests have confirmed the popular view that uniformity of delivery rate is achieved with much greater certainty with granulated material. Most of the compound fertilisers now used in Britain are today granulated. It can be said, then, that the two basic and practical principles for ensuring even applications are in fairly general operation—the metered, horizontal-flow type of appliance and the free-flowing granular type of fertiliser. What is now called for is steady progress from these two bases, and Dr. Cooke rightly calls for the formation in this country of some organisation that will co-ordinate the views of agronomists, makers of machinery and manufacturers of fertilisers. In the United States such an organisation already exists—the National Joint Committee on Fertiliser Application. His plea is by no means the first, but perhaps it will attract more attention than previous efforts. Certainly progress so far achieved has come about in a somewhat haphazard manner.

Sulphur and pastures

IT is too often forgotten that sulphur is one of the major plant nutrients. Its supply in soils is largely taken for granted. It is in any case a useful constituent of superphosphate and sulphate of ammonia, two of the most widely-used fertilisers. To what extent the level of sulphur supply in soils has been maintained through the ' free ' sulphur in these fertilisers is probably impossible to assess. However, there are tendencies today to move away from these sulphur-containing fertilisers, to use ammonia and ammonium nitrate as sources of nitrogen, to make more concentrated superphosphates by treating mineral phosphate with phosphoric acid instead of with sulphuric acid or to develop nitrophosphates instead of superphosphate. These tendencies have been partly stimulated by the 1949-51 world sulphur crisis and partly by demand for fertilisers of higher analysis.

There is timely reminder of the importance of sulphur in superphosphate in recently reported New Zealand research (P. D. Sears, *N.Z.J. Sci. and Technology*, **35**, 1A, Supplement, 1-77, 1953). During five-year pasture tests it was suspected that some responses to superphosphate were not due simply to its phosphate content. Sub-plots were laid down in which mono-calcium phosphate and calcium sulphate were applied separately and together. In rather less than twelve months, calcium sulphate had 'markedly increased the growth of white clover ' ; responses to the phosphate-without-sulphate treatments were poor, but on the plots where both mono-calcium phosphate and calcium sulphate were given the growth of white clover and grasses was the best of the three compared treatments. The ' conditions ' of these plots were ' regular mowing,' *i.e.* removal of herbage to approximate to grazing removal, but without the return of animal dung and urine associated with grazing. Such conditions might well cause the speedy development of sulphur shortage. Clearly enough, on the New Zealand plots, sulphur supply was a more critical factor than phosphate supply, for sulphate alone gave better results than phosphate alone, and not until sulphate was given with phosphate were the best effects obtained.

Crop Prospects in the South Pacific

ERIC FORD, B.Sc.

The South Pacific Commission is exercising a marked influence over conditions in the vast area which it is intended to benefit. We have already given an account of its work in regard to cocoa. WORLD CROPS, *Vol. 5, page 393. In the following pages its activities in the agricultural field as a whole are reviewed.*

TRADITIONALLY, the native peoples of the coral islands and atolls of the South Pacific are believed to live in ease and plenty beneath their waving palms. In actual fact here, as elsewhere in the underdeveloped sections of the world, the emphasis is on the need to raise living standards by improved exploitation of the crop resources of the region. Schemes for improving the cultivation of existing crops, for introducing new ones and for developing marketing techniques loom large among the work programmes of the South Pacific Commission.

The South Pacific Commission

This international organisation comprises representatives of Australia, France, the Netherlands, New Zealand, the United Kingdom and the United States—the six powers responsible for the non-self-governing territories dotted sparsely over 13 million sq. miles of the Pacific Ocean. The Commission's sway thus extends as far as the Marianas in the north, to Tahiti in the east and reaches out to New Guinea in the west. Set up in 1947, the Commission acts as an advisory and consultative body, with the primary duty of making recommendations to the member Governments in regard to the promotion of the well-being of the peoples committed to their charge.

Prominent among the considerations which have led the Commission to pay such close attention to cropping developments in the area is the pressure exerted by increasing population on existing food resources. This pressure would probably persist even if the native inhabitants continue to subsist at the traditional levels. But since it is the Commission's policy to raise health standards by introducing new and better diets, an even greater expansion of home-grown food will be necessary. Moreover, rising living standards will in turn lead to demands for imported food and other products, and these will have to be balanced by exports of the region's cash crops. On all these counts, therefore, a vital need exists for considerable expansion of crop production of the South Pacific area.

Coconuts

Both for subsistence purposes and as a cash crop, the various products of the coconut palm have long been regarded as the main asset of the South Pacific region. Not unnaturally, the Commission is expending considerable effort on projects to develop this staple product still further. Typical of the work in this direction is a project for coconut selection and plantation rehabilitation in Samoa in which the Commission is associated with the New Zealand Government which operates the New Zealand Reparation Estates on the island.

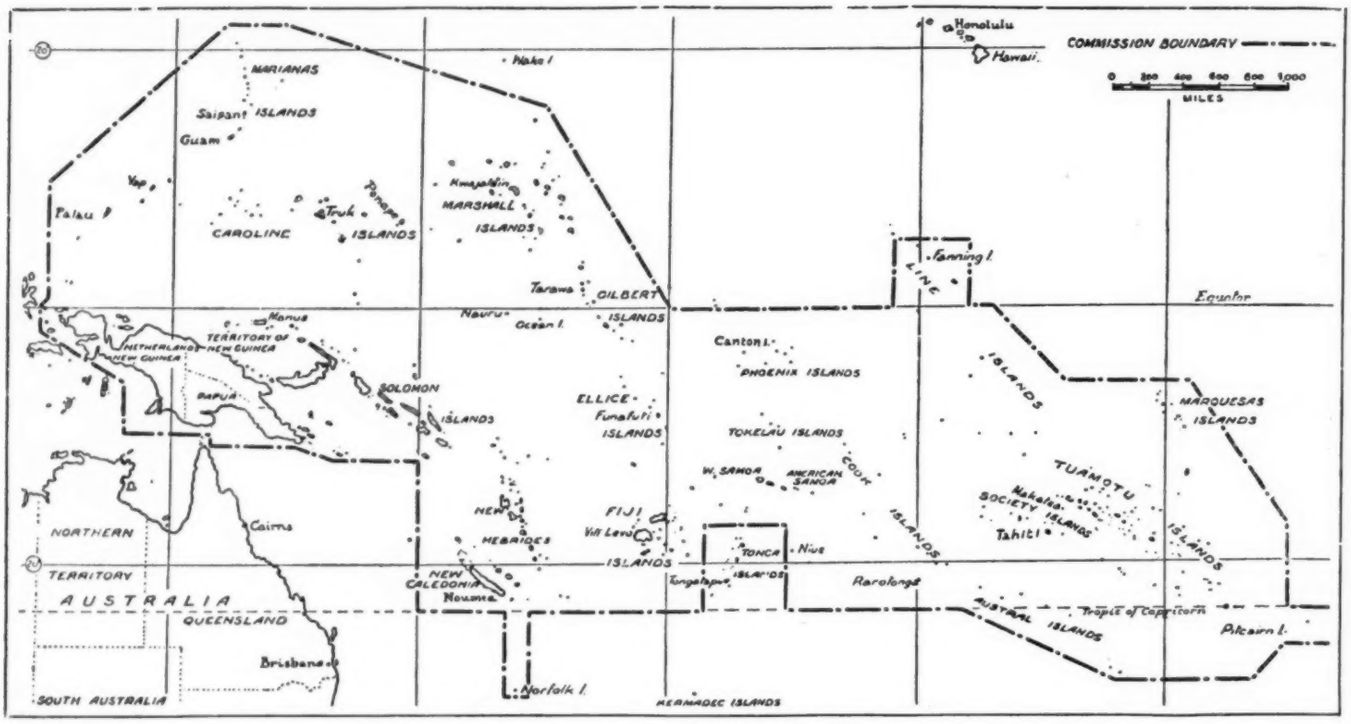
About 200 acres of old coconut land have been cleared and ploughed and cross-ploughed to an average depth of 6 in. As a preliminary step, in December 1951 a 25-acre section of this area was sown under Mauritius bean (*Mucuna aterrima*). Within seven days, the seed germinated and by mid-January 1952 the plot was completely covered by the vines. Five months later, by which time the vines were in flower, this crop was ploughed under and the plot was lined and planted with selected coconut seed nuts. This procedure has since been repeated and will continue at intervals until the complete 200-acre plantation is under coconuts.

So that each plant shall have ample room for growth, the seed nuts are planted in squares with 30-ft. spacings. giving 48 palms to an acre, *i.e.* 9,600 palms for the whole plantation when complete. As each seed is planted, it is given a number. This number is plotted on a master plan of the plantation and a record kept of its territory of origin as well as any other appropriate data.

The procedure adopted at the coconut nursery where the seed is raised is as follows. Some of the seed employed is from specially-selected local stock and some is derived from Malayan seed material. The seed nuts are taken from palms which are heavy bearers carrying their fruit on short stalks with an evenly-distributed head load of nuts. The fruit selected is medium in size, oval in shape, evenly rounded at the median bulge and with a thin husk. The inner shells are nearly spherical with an average thickness of kernel of .52 in.

From this experiment it is hoped to derive useful lessons in connection with replanting elsewhere in the region. The Commission's coconut specialist, Mr. W. V. D. Pieris, formerly of the Ceylon Coconut Research Station, pointed out in 1952 that measures such as this are needed to offset the declining coconut yield which is a general feature throughout the South

Spraying in a citrus orchard, Rarotonga



This map shows the area of the South Pacific Commission

Pacific. This decline, he explained, is mainly due to the fact that most coconut palm plantations are well over 60 years old, so that decreased output is inevitable. To overcome this fall in productivity, Mr. Pieris urged steps to establish new plantations, but since this is a long-term policy, he also suggested measures to improve those already in production. These included the thinning out of overcrowded groves, the selection of high-yielding mother plants and seed nuts, improved nursery management, seedling transplanting and after care, better plantation sanitation and the prevention and control of pests and diseases.

Of the pests which afflict the coconut palm, none is more feared than the rhinoceros beetle (*Oryctes rhinoceros*), which is found particularly in the Palan Islands, New Britain and New Ireland, Samoa and Wallis Island. Recently it reappeared in the Tonga Islands, which, although a self-governing territory, shares in the Commission's activities where applicable. An outbreak occurred in Fiji in March 1953 when a female beetle was discovered under the hatch of a vessel from Western Samoa, while another was found in a Fijian house on the Suva Harbour foreshore.

Subsequently it was discovered that an infested area existed on the island, and an eradication campaign was at once put into action. The measures adopted include the destruction of breeding places and quarantine precautions to prevent the spread of infection by inter-island shipping. Regulations were put into force forbidding the removal without permission of soil or compost material from the infected area. All dead coconut palms in the area have to be burnt or thrown into the sea or river, or split and the split pieces stacked so that the air can circulate freely around them.

Occupiers or owners of land are required to report the presence of beetles and to destroy them. Inspectors are empowered to see that these duties are efficiently performed. Stringent regulations control the movements of all vessels of 2 tons or more and, at inspection points on roads in affected areas, all vehicles may be stopped and examined.

Long-term plans for coping with this menace are in the hands of the Commission's plant and animal quarantine officer. It is proposed that two entomologists and a chemist should be drafted into the campaign. One of the entomologists will pay special attention to the possibility of controlling the beetle through the use of parasites or predators introduced from elsewhere. One possible parasite (*Scolia ruficornis*) which was collected in Zanzibar towards the end of 1952, has already been introduced and liberated in the Rabaul area of Papua and New Guinea. As the second part of this attack on the rhinoceros beetle, the second entomologist would be engaged in testing attractants, studying beetle ecology and colonising the parasites in Western Samoa. Meantime, the chemist of the team would be working on the preparation and testing of possible attractants.

Throughout the project, which is scheduled to take three years, particular attention will be paid to experience in India and other nearby countries where the beetle is believed to have its original home. The fact that the beetle does not do as much damage in India as it does in the Pacific suggests that methods of control in the former area merit attention.

Cocoa

Although much of the Commission's attention is naturally concentrated on the products of the coconut palm, it is by no means unmindful of the possibilities of other cash and subsistence crops. One cash crop which has already attracted attention is cocoa. Indeed, Mr. D. H. Urquhart, formerly Director of Agriculture in the Gold Coast, and a world authority on cocoa, who recently visited this region, has expressed his opinion that Western Samoa in particular offers '. . . more promising prospects for increasing cocoa production than any other cocoa-producing country in the world.'* He bases this statement on the high yielding capacity of Samoan trees, plus the fact that one particular variety (named *Lafi* 7) possesses remarkable resistance to *Phytophthora*, a disease which causes considerable loss of production in Samoa.

Cocoa planting is actively proceeding in other territories in the region, notably in

* A summary of Mr. Urquhart's report appeared in WORLD CROPS, Vol. 5, page 393.

Papua and New Guinea. The village people are reported to be participating enthusiastically, having already planted over 500,000 trees in the Rabaul area. The Vunamami Village Council has sponsored the erection of a central cocoa fermentary for handling the produce of the 30,000 to 40,000 trees in this area.

Introduction gardens

Much experimental work on cocoa breeding, selection and propagation is in progress at the various ' introduction gardens ' in different parts of the region. At these agricultural stations, non-indigenous plants are ' introduced ' to their new habitat and tried out. They represent an interesting aspect of the Commission's activities, especially as the South Pacific region is characterised by a marked paucity of indigenous economic plants. The primary object of these introduction gardens is to help the diversification of food and export crops, but they also serve as bases from which agricultural officers can carry out their work of raising cultivation standards among the village farmers.

Developments in New Guinea

A good example of the value of these introduction gardens in varying the crops in an area is seen in Papua and New Guinea where a number of them have been so sited that plants can be tried out under low-level, medium-level and high-level conditions. At these stations more than 500 different types of crops are under observation.

An area 300 acres in extent is available at the main lowland experimental station at Keravat near Rabaul, where the current activities include cocoa breeding, selection and propagation, manila hemp selection and propagation, entomological research on cocoa and coconut palm pests and the demonstration and testing of oil-palm. Other crops under observation here include coffee, fibres (including kenaf, manila hemp, sisal, *pandanus* and abrowa), kapok, pepper, cinnamon, vanilla, derris, cotton, castor bean, rubber and certain indigenous food crops.

Collecting cocoa beans in Western Samoa

High-level crop conditions exist at an experimental station at Aiyura (altitude 5,500 ft.), where the crops under observation include cinchona, coffee, tea and pyrethrum. Apart from its research work, this station provides coffee and tea seed to planters and produces cinchona bark for malaria control purposes for the Health Department. Local food crops introduced through this station include the tree tomato (*Cyphomandra*), now almost a staple article of food in some areas. Cereals, beans and root crops have been distributed throughout the Highlands. At Aiyura, too, was developed the passion-fruit culture which now provides a means of livelihood for many local inhabitants, both native and European, the fruit juices and pulp being sold to an Australian company.

Rice production

Experimental work on mechanised rice production, the breeding and selection of rice strains and the production of rice seed is also in progress at this station. This forms the basis for several important rice-growing projects in various parts of Papua. The purpose of these projects is to demonstrate to the people the value of rice as a cash crop. No fewer than 59 villages are engaged in one of these projects, at Amele. Elsewhere, attempts are being made to encourage the villagers to grow more rice in their gardens. For this purpose, rice-processing machines and hand tools are being sold to the villagers on easy terms.

Tea

At Garaina (altitude 2,200 ft.), the medium-level station, one of the chief activities is carrying out experiments on tea growing under semi-commercial conditions up to the final stage of processing for market. This station also provides seed and planting materials to private estates and provides planters with valuable technical and economic information.

Conditions on coral atolls

One of the most difficult problems facing the Commission is the question of the economic future of the numerous coral atolls in the area. Experimental work in this direction is being carried on at an introduction garden at Naduruloulou in Fiji, where many crops are now established so that the more promising varieties can be propagated and later distributed to improve the economic prospects of the coral atoll dweller. To this end, sweet potatoes, arrowroot, legume plants, grasses, *pandanus* fibre, yams, taro and certain ' strand ' plants have been assembled for experimental work at Naduruloulou. Other possible future atoll crops have been brought in from outside the South Pacific area in the

Hereford beef cattle on a farm at Zenag in the New Guinea highlands

Part of 15 acres of tea at Garaina in the Waria Valley. Both upland and lowland varieties of tea grow well in New Guinea and Papua

belief that they may prove successful. These include sweet potatoes of the bush variety from Texas, black pepper from Singapore, manila hemp from Malaya, rice from British Guiana and lucerne from Chile, Africa and India. Plants now growing at Naduruloulou also include material from New Zealand, Puerto Rico and Australia.

Wide as is the range of cash and subsistence crops established at the introduction gardens, it by no means exhausts the cropping possibilities of the South Pacific area. Rubber, for example, which is already grown on a number of plantations in Papua, is considered to be a potential and valuable export crop for large areas of this territory. A recent report by the Australian Department of Overseas Territories indicates that large areas in Papua and New Guinea are suitable for rubber production, both as to climatic and soil conditions.

Citrus crops

Mr. M. B. Baker, Director of Agriculture, Cook Islands Administration, has described the reorganisation of the citrus industry in that territory. A vigorous policy of re-planting and modernisation is being pursued in an attempt to expand an industry which was formerly based on fruit derived from trees growing in a semi-wild state. He states that ' The reorganisation involves the re-education of growers in up-to-date methods of cultivation, spraying and handling of fruit to take the place of the rough-and-ready methods with which they were able to get by before other countries commenced to compete in the New Zealand market. This policy is being pursued with some success after many difficulties in the initial stages.'

One result of this expansion of citrus fruit production will be an increased demand for box timber on which £50,000 is already spent annually outside the territory. Among several possible soft woods, it has been demonstrated that a species of *Albizzia* makes rapid growth in the Cook Islands. Mr. Baker believes that extensive tracts of land at present unutilised are available in Rarotonga and elsewhere in the Lower Cook Group, for trial plantations of the *Albizzia*. If this project proves successful, it should assist not only the Cook Islands but also other territories like Fiji, Western Samoa and Tonga, where box timber is needed for banana exports.

A line of native tappers on a Papua plantation brings in latex to the factory

Land use

Success in crop introduction and development, however, is not the only requisite for a healthy economy. Considerable research of a more general nature is necessary to ensure the optimum development of an area of the extent and diversity of the South Pacific regions. In particular it is necessary to obtain an overall picture of the use which is being made of the land area of the South Pacific in order to ensure balanced development. This the Commission plans to do by land use surveys, the aim of which is the correlation and dissemination of information on land utilisation derived from surveys carried out by individual administrations.

As a first step, it will be necessary to make a rough classification of the region into areas suitable for agricultural, pastoral and forest use. This will entail the assembly of reliable climatological data and maps showing the main soil types. Aerial photography can be of great importance here. Dove-tailing into this is another Commission project under which territorial administrations are assisted in the planning and execution of economic surveys, and at the present Mr. V. D. Stace, of New Zealand, is working on an economic survey of Western Samoa.

Conclusion

It is clear that many activities involving different techniques are required to bring to fruition the cropping potentialities of the South Pacific region. Each individual administration had long recognised the need to develop crop resources within its territories and there was already an impressive record of experiment and development in pre-Commission days. It is the function of the Commission to make easy the problem of development by bringing the resources of six nations to bear on questions common to the territories of all.

This the Commission is doing by means of a combination of experimental work and the application of known and tried techniques. So far as crop problems are concerned there will be general agreement with Dr. E. M. Ojala of New Zealand (Deputy Chairman of the Commission's Research Council) when he said: ' I believe that the Commission is already providing a demonstration to the world of what six nations can accomplish when they decide to work together for the development of the people and the resources under their care.'

Photos : P. 47 and 49 (top), New Zealand Government, p. 49 (bottom) and p. 50, Australian Government.

The Fate of Collective Agriculture in Yugoslavia

DR. C. de FELLNER

Dr. de Fellner's earlier article on collective farming in Yugoslavia appeared in WORLD CROPS *in December 1951. Last summer he again visited the country and his observations and impressions are recorded below. It is noteworthy that his earlier prognostications concerning collective farming have been amply fulfilled.*

TWO years have passed since the author reported in these pages on some aspects of collective farming in Yugoslavia. There is one thing that has remained unchanged since then in that country: in 1953 just as in 1951 no veils of political propaganda hid the truth about collective farming, and nothing today stands in the way of the observer who wants to pursue his studies. In other countries where collective farming prevails the fate of the farming community can be watched only indirectly. A political smoke screen hides all approaches and the information available is confined to the public utterances of Governmental heads, the publication of new regulations, the official announcements of new policies and statistical data of doubtful value. In Yugoslavia today, however, nobody is trying to conceal facts, whether they are pleasant or unpleasant, and all data are available.

The author visited Yugoslavia during last summer and had an opportunity of studying the latest developments on the spot. His impressions are summarised as follows.

The present position

Collective farming in Yugoslavia has failed. It was an artificial system and, however strong the pressure and coercion used, the peasant population resisted so tenaciously that the advocates of the system at last became convinced of the futility of their efforts. There is nothing exceptional about this. The latest information from behind the Iron Curtain shows that 35 years of strongest coercion could not make a success of collective farming in Russia; it has also failed in all the satellite countries, where its introduction has been the core of the agricultural policy of post-war Communist governments.

It is undeniable that an imposed policy can succeed to a certain degree in agriculture, but only as long as the whole economic structure of the country is centralised and centrally directed. The first steps Yugoslavia took after the war were in this direction. However, its policy-makers soon found that, no matter what Moscow may preach, this system is alien to their country. Centralisation leads inevitably to the preponderance of bureaucracy. This might conceivably bring about success in countries with an efficient staff of civil servants, but in Yugoslavia bureaucracy had no established tradition, and decentralisation with a system of some kind of semi-free competitive economy seemed better suited to the diversified needs of the country. Accordingly, as soon as this new economic policy was introduced, its immediate repercussions on agriculture made it plain that the collective farming system was unworkable and had to be abandoned.

Collective farms

Collective farms are called in Yugoslavia ' Peasants' Working Co-operatives.' They are a group by themselves, distinctly different from other co-operatives. The latter not only have a pre-war tradition but they are virtually an up-to-date form of the ancient Slav system of village tenure, and are fully accepted by the peasants. The following table shows what happened to the co-operative system between the end of 1951, peak year of the Yugoslav collective farming system, and July 1953:

	Number of Co-operatives	
	End 1951	*July* 1953
General Co-operatives	7,581	7,250
Peasants' Working Co-operatives ..	6,797	890
Specialised Agricultural Co-operatives	129	178
Industrial Production Co-operatives ..	1,156	1,061
Industrial Consumption Co-operatives	221	213
	15,884	9,592

An analysis of these figures shows that the insignificant reduction in the number of general co-operatives is solely due to the fact that some reorganisation has taken place, and a few co-operatives have amal-

The Federal Republic of Yugoslavia

gamated. A most remarkable reduction occurred, however, in the number of Peasants' Working Co-operatives. This is nothing less than a landslide, which cannot be explained otherwise than by the complete failure of the system. On the other hand, there is a distinct upward trend in the numbers of the specialised agricultural co-operatives—dairy co-operatives, co-operatives for livestock breeding, fruit or wine production, etc.—which are very popular and pay good returns to their members. The numbers of the last two types of co-operatives show no change. They are organised for the benefit of handicrafts and small industries on the land, and have little direct bearing on agriculture.

Causes of failure of collective farming

The so-called Peasants' Working Co-operatives are the most important factor, and it may perhaps be useful to recapitulate some of the main reasons why the system was started at all. There was, of course, the Marxist pattern as a political dogma to be followed, but the main practical reason was that it was believed that the introduction of collective farming would release badly needed manpower for other purposes. It was also expected that large agricultural units would have a higher output than small dispersed ones, that mechanisation could be introduced with less difficulty and that the directed system of production could deal more efficiently with a reduced number of large farms than with numerous small ones. And last, but not least, the vitally important compulsory quotas, on which the success or failure of the system depended, could be controlled effectively only on large farms, as it is common experience all over Central Europe that smallholders always find ways and means of evading deliveries.

Of all these assumptions only two proved right. Manpower was successfully diverted from agriculture to other branches of the economy and the delivery system as such showed some improvement, but the hostile reaction of the peasantry nullified every effort and yields were reduced in a most alarming way. Farmers cut down their output to their lowest personal needs and did nothing to increase yields, having no interest in selling or delivering a surplus. These trends prevailed not only on the smallholdings which had not yet been forced to enter the co-operatives and languished under a punitive tax system, but applied also to the unwilling members of all collective farms, who had no reason to exert themselves for the benefit of an unpopular system of land tenure.

Ploughing at a co-operative farm

Two further causes of the failure were the lack of efficient agronomists and co-operative leaders on the one hand, and on the other an extravagant accountancy system which flooded the farms with book-keepers and accountants. They were naturally most unpopular; members considered their work superfluous and the general opinion was that they could be put to much better use taking an active part in the daily farm work instead of bullying members with inefficient administration.

The turning point

Two years ago I expressed doubts whether the leaders of the collective farms, who had very little practical experience and no commercial aptitude at all, would be able to cope with the complexities of competitive marketing. Subsequent events have justified these doubts and, with few exceptions, their leadership proved disappointing. This proved a decisive factor when the Yugoslav economy was transformed from a centralised, State-directed system to a decentralised competitive system of individual economic units. In this system, individual private enterprise has been replaced by a series of nationalised but independent enterprises in all branches of economic life which have to compete with each other in the same way as private enterprises do in the West.

The planners of this economic system foresaw that most of the collective farms would be unable to fit into this scheme and it shows a remarkable degree of self-criticism that they decided to abandon collective farming, probably with a secret sigh of relief, as the downward trend in agricultural production furnished ample proof of its unpopularity.

New legislation

In April 1953 the Yugoslav National Assembly passed a new decree which dealt with the settlement of the property relations and the reorganisation of the Peasants' Working Co-operatives. In actual fact, this decree confirmed many of the original regulations laid down when the co-operatives were started, according to which participation in a collective farm was completely voluntary and members could join and leave of their own free will. The property relations between the co-operative and its members were to be decided freely, the terms of payment and the rent to be paid for the land with which a member entered a co-operative, as well as for the livestock and other inventories and dead stock he brought into it, was to be subject to free agreement, and should a member be dissatisfied with the rulings of the majority he was supposed to be at liberty to leave the co-operative after settling any liabilities he might have incurred towards it.

Some important features of the new decree were that: (1) all disputes arising between the co-operatives and their members have to be dealt with by the regular law courts, (2) the management of each co-operative is organised on a completely democratic basis and is elected by majority vote of all members, (3) one part of the co-operative's income has to be used for the renewal of its inventory and for betterment, while a contribution must be made to the general development fund of the country (this is equal to a 3% income tax

on the total yearly income of the co-operative). Other regulations provide for the creation of a land reserve fund. To achieve this end no member can leave the co-operative with more than 10 hectares (about 22 acres of land), regardless of the acreage with which he entered it; the surplus land thus acquired constitutes the land reserve fund.

The same maximum is applied to all land and property, which means practically that with certain exceptions 10 hectares is the maximum acreage of any private holding. These regulations naturally aroused some resentment, which however was tempered by the fact that so long as the fund has no use for the surplus acreage this can be temporarily allotted to the previous owner; there is widespread hope among the peasants that ultimately some or all of the earmarked lands will remain permanently in the hands of their previous proprietor.

The future outlook

What is the probable future of the remaining 10% of collective farms? It seems inevitable that the more efficient members will leave the collectives in order to farm on their own, and of the remaining members only a very few are enthusiasts who believe that they can succeed best if they remain on collectives. Most of them will either come from the ranks of previously landless agricultural workers who are too poor and have too little experience to work on their own, or from settlers from the backward parts of the country who have been allotted previously German-owned farms in the fertile northern plains. These farmers have little knowledge of intensive farming and receive real help and guidance in the co-operatives. If these greatly reduced numbers of workers are led and directed by efficient agronomists, they may prosper, as the running co-operatives will be the only large-scale farming enterprises in the country except the State farms. They will undoubtedly have a good chance in a country of smallholdings and as, under the new policy, it is intended that the Government should give extensive help to agriculture, it is probable that the co-operatives will get considerable facilities for mechanisation and land improvement.

Harvesting an improved variety of wheat

Pig breeding and fattening yards at a co-operative farm

No statistical data are yet available since this change of agricultural policy took place and, if there were, they would have to be regarded with extreme caution. It should be borne in mind that Yugoslavia has had a series of extremely bad harvests during the last five years as a result of drought and other adversities of nature, while 1953, on the other hand, was a very favourable year with exceptionally good crops. Nevertheless, it can be safely said that the whole aspect of Yugoslav agriculture has changed of late. Work is in full swing all over the country, and the same peasants who, while they were sullen members of the collective farms, hardly worked more than was absolutely necessary, now toil full of ambition and zeal from daybreak to late at night.

Some conditions

The fate of collective farming in Yugoslavia does not, of course, prove that the system itself is either right or wrong, but it does provide indications as to points which have to be kept in mind if and where collective farming is introduced.

As a system of land tenure which is not the result of natural or historical development but an artificial superimposition, it can succeed only where the facts convince the farmer that to enter a collective means greater prosperity for himself. This again will depend upon whether land topography and current use are better suited to large-scale farming than to smallholdings. Rolling open plains suit large-scale operatives better than hill country; cereal or sugar-beet production better than vegetable or fruit growing and dairy farming or livestock fattening better than livestock breeding. Mechanisation is the simplest method of reducing production costs and is a most important factor for success. Other points are that a simple but effective book-keeping system has to be worked out and put in operation, while no success can be achieved unless well trained agronomists and co-operative workers are available to organise and direct the work of the collectives. They should have, besides wide technical knowledge, ability and, if possible, practical experience in marketing; this is of great importance in view of difficult marketing conditions likely to arise in the future and moreover, problems of surplus production probably loom ahead.

Yugoslav agriculture has a different kind of problem to solve. Agriculture has been neglected up till now and will have to be guided to find its right place in the new economic system. Agricultural planners and administration officers were inclined in the past to confine themselves to adminis-

trative problems instead of building up an efficient agricultural policy for the country which would indicate the road to development. They will have to learn the difficult lesson that agriculture is a most peculiar branch of the economy of any country, which requires full freedom of action and at the same time an imaginative lead, guidance and effective help in presenting its production programme, combined with the best use of available land for the benefit of the needs of the country.

It is fortunate that Yugoslavia is free to adopt from the West up-to-date methods of indirect inducement, such as for instance minimum prices for commodities, open or veiled subsidies, special credits, standardisation and so on, which can replace with infinitely better effect the compulsory methods practised in the earlier post-war years. The new Ten-Year Plan for Agriculture, which will be published soon, will show which of these methods will be applied to the agriculture of Yugoslavia.

The Imperial College of Tropical Agriculture

IN the report on the work of this College for the two years ending September 1953, which has just been published in Trinidad and London, the Acting Principal states that these two years ' mark the completion of the post-war programme of expansion which has doubled the staff and laboratory accommodation. This period also witnessed the end of one financial quinquennium and the start of another, and the completion of the first five-year programmes under the research schemes for bananas, cocoa, soils and sugar.'

Teaching

The College offers five main courses: at undergraduate level, diploma courses in general agriculture and in sugar technology (D.I.C.T.A.), each of three years' duration; at postgraduate level, Associateship courses in agriculture and sugar technology (A.I.C.T.A.); and also at postgraduate level a one-year diploma course in tropical agriculture (D.T.A.Trin.). Special refresher and one-year courses are also provided for staffs of agricultural departments in the dependencies.

The original farm attached to the College was too small, and a new College farm has been set up on 300 acres given by the Trinidad and Tobago Government; it held its first agricultural show in 1951. Some 170 acres have now been cleared and are being developed as a mixed farm with emphasis on sugar cane and livestock. The farm is equipped with a wide range of agricultural machinery and up-to-date farm buildings. Five experimental peasant units are in operation near the College, providing examples of different types of holdings for investigation, as most students are destined to work with peasants.

Research

All members of the academic staff and postgraduate students participate in the research activities of the College, and the four five-year major research schemes on bananas, cocoa, soils and sugar were completed during the period reviewed.

The Banana Research Scheme is being conducted in both Trinidad and Jamaica and has centralised the hitherto scattered researches in the two territories. Research into diseases has made it evident that there is no hope of achieving effective practical control of Panama disease, and, while Leaf Spot disease can be effectively controlled by spraying, the process is extremely expensive; emphasis is therefore placed on breeding disease-resisting varieties of bananas. Some very good varieties have been bred, with satisfactory storage and ripening characteristics, but it is not yet certain that they have sufficient resistance to Leaf Spot.

The Cocoa Research Scheme, which aims to improve the standard of cocoa cultivation, yield and quality, includes work on plant breeding, the study of pests and diseases, and research into cocoa soils. Sample plants from many countries have been tested for high-yielding qualities, and a cocoa-collecting expedition to the forests of Colombia, calculated to last a year, set out in August 1952. Work has been done to discover the importance of shade, and the results of injection with minerals and of spraying with hormones; much time has been devoted to eradication of pests such as cocoa thrips, mealy bugs and red spiders, and of diseases such as witches' broom and black pod. In the control of witches' broom disease it is concluded that pruning methods are more economical than spraying. Experiments are being undertaken into growing cocoa on deteriorated land by methods involving mechanical cultivation.

The Soils Research Scheme aims to provide accurate information upon which to base the better utilisation of the land, the conservation of soil and the planning of suitable agricultural systems for the various territories. During their training, soil surveyors have carried out small soil surveys as field exercises in Grenada, Barbados, and British Guiana. Most of the soil research has been done in the laboratories in Trinidad where a spectrographic apparatus is now receiving preliminary trials. Irrigation studies and investigations into soil deterioration have been undertaken, and a researcher provided by a Dutch firm has been working on fertilisers.

The Sugar Research Scheme is under an advisory committee consisting of three representatives of the College and one from each of the seven member territories of the British West Indies Sugar Association (Inc.). The College has an experimental sugar factory where technological investigations are conducted into such processes as the production of clear, clarified juice. Analytical work is proceeding, and also work on by-products such as bagasse (the fibre of the sugar cane), wax, and lactic acid made from molasses. From bagasse, paper has been made which is rather stronger than the newsprint used in the United Kingdom.

(*Commonwealth Survey*)

A New Selective Weedkiller

A new liquid hormone selective weedkiller, ' Agroxone ' 4, has been developed by Plant Protection Ltd. and will be available to British farmers in 1954. This new weedkiller is based on the *potassium* salt of MCPA, which will replace the *sodium* salt, previously the standard form of MCPA selective weedkillers.

' Agroxone ' 4 is said to be purer, more concentrated and the active agent to be more soluble than most other forms of MCPA. Again, because ' Agroxone ' 4 is more concentrated, farmers will find it somewhat easier and quicker to mix. For the more susceptible weeds, such as charlock, only 1½ pt. of ' Agroxone ' 4 are needed (as against 2½ pt. of ' Agroxone ' Triple Strength), and for less susceptible weeds 3 pt. of the new product (as against 5 pt. of Triple Strength). Large- and small-scale experiments, supervised by Dr. H. P. Allen, Senior Botanist of the Fernhurst Research Station, throughout this country and in Canada, South Africa, Kenya and elsewhere, are claimed to confirm the biological efficiency of ' Agroxone ' 4.

The Australian Sugar Industry

T. A. G. HUNGERFORD

THE production of cane sugar, of which 95% comes from the State of Queensland, is one of Australia's greatest and most highly organised industries. In a normal year it yields from 6 million to 6½ million tons of sugar cane, from which is extracted sugar valued at more than £A23 million at present-day prices. Farm equipment, land and mill assets have an estimated value of £A100 million, which is almost entirely in the hands of farmers whose yearly production of cane is about 1,000 tons each. It is still the only sugar industry in the world that employs labour at rates attractive by Australian standards. Over 33,000 Australians find employment on cane farms and another 6,400 work in raw sugar mills; in sugar-growing districts and elsewhere a further 51,350 are indirectly employed by the industry.

It is estimated that about 200,000 people —a fifth of Queensland's population, is supported by the industry in that State, while the refining, transport and distribution of sugar in other States provides employment for further thousands. In addition, there are factories which use sugar as a raw material in their products; in New South Wales alone there are 400 such factories in which more than 50,000 people earn their livelihood.

The history of sugar growing in Australia

It is believed that the original home of the sugar cane is in New Guinea, from which it spread to most parts of the world, but not to Australia. Despite its closeness to New Guinea, Australia has no indigenous cane, the first cuttings having arrived there in 1788. The first records of sugar manufacture date from the 1820s; before 1865 small areas of cane were cultivated in New South Wales and southern Queensland, and in that year a small mill was established at Ormiston, on the shores of Moreton Bay, close to Brisbane.

The fertile lands of Bundaberg and Mackay were soon planted to cane and during the following two decades similar development spread north to Townsville, with many small mills producing increasing tonnages of sugar. In those early days the cane fields were worked by indentured labour from the South Sea Islands, but Australian Federation in 1901 forced the industry to use European labour in cane sugar production. The innovation was successful and brought significant changes in its train.

In previous issues of WORLD CROPS *we have published accounts of the sugar industry in various parts of the world. As a further contribution we reproduce below an outline account of the sugar industry in Queensland, Australia, which has developed in such a remarkable fashion during the past eighty years.*

The plantation system, in which huge tracts of cane lands were worked by single concerns employing hundreds of labourers to cut and transport the cane, gave way to small farms each worked independently by Australian farmers, and the small, inefficient and, in all probability, unhygienic plantation mills, which in 1888 numbered 166, were abandoned in favour of large, centrally situated mills where the cane could be treated more cheaply and efficiently.

The industry today rests upon a sound foundation of 9,000 individual farmers each holding an average of 50 acres of land; there are two mills in New South Wales and 34 in Queensland, of which almost half are co-operative concerns owned and administered by the men who produce the cane.

Location of the industry

The sugar cane areas of Australia are scattered along the plains of the eastern coast. Their northern extremity is at Mossman, in Queensland, on 16°S latitude. They extend south for some 1,300 miles to the Clarence River area, in northern New South Wales, on latitude 29°S. Such a distribution covers a very wide range of climatic, soil and cultivation conditions. For instance, the average yearly rainfall at Cairns, near the northern extremity, is 89 in., with a normal average maximum temperature of 85°F.; the corresponding figures at Harwood, in the Clarence River district, are 45 in. of rainfall and a temperature of 78°F.

In its virgin state the land usually carries a heavy cover of jungle growth. Clearing, formerly a heartbreaking business of ringbarking, grubbing and burning off, is now done with bulldozers, but it is a costly operation.

Preparation and planting

The preparation of the soil must be thorough if the best results are to be ob-

Burning off cane in the Mackay district, northern Queensland. This practice eliminates the thick undergrowth of trash, or leaves, and makes the work of the cutters much easier

tained. It usually begins 18 months or two years before the harvest of the first, or plant, cane crop of the three crops usually taken off before replanting. Three or four ploughings are carried out to a depth of 10 in. or 1 ft., according to the depth of topsoil overlaying the heavy clay subsoil, with intermediate harrowing to break the surface into a comparatively fine tilth. Cane is propagated from ' setts,' *i.e.* short lengths of cane cut to embody three joints and eyes.

Cane is a gross feeder and, except when soils are very deep and fertile, soon exhausts much of the available plant food. Some of the lands around Mackay, the most productive cane area of the north coast, have been growing excellent crops of cane for between 50 and 60 years with the help of heavy dressings of fertiliser at planting.

In planting the setts were formerly prepared by hand, placed by hand in 6-in. deep furrows and covered over with a hoe. Sometimes the whole cane was placed in the furrow and there chopped into setts, but whichever way it was done it was a time-consuming and back-breaking job.

Now the whole operation is done by a wheeled mechanical planter manufactured in the Mackay area. Drawn by a tractor, it is operated by one man seated on the platform of the machine, from which, working each hand alternately, he feeds lengths of cane into the throat of a funnel in which a knife, worked by a ratchet from the revolving wheels of the planter, moves backwards and forwards cutting the cane into the desired lengths for setts. As the cane is cut it is coated with a mercurial spray to protect it from pineapple disease, which attacks cane setts and takes its name from the pineapple smell which characterises it.

Fertiliser is also added from a reservoir behind the operator in varying quantities, according to the needs of the land; soil analyses are carried out by the local sugar experimental station and checked every three or four years. Around Mackay the usual dressing is up to 5 cwt. of superphosphate to the acre; to this is added 37 lb. of gammexane for the control of the white grubs that infest the land and attack the setts and the roots of the cane. The furrow to accommodate the setts is dug by a small steel snout below the platform of the machine. Directly behind it tines throw earth inwards to cover the setts and a small wooden roller, tailing the whole set-up, flattens the earth over them. Each loading of the machine is sufficient for 45 chains of planting.

These operations result in a continuous line of setts in the ground, surrounded by fertiliser, and protected from attack by disease. From each of the eyes, there emerges a primary shoot, from the base of which in time come the subsidiary shoots that form the ultimate stool or clump of cane.

The cane is generally cut by contract gangs and includes the felling of the cane, the lopping of the bushy tip, and loading it on to trucks for transport to the mill

Cultivation and harvesting

Between the time of planting and the harvesting of the mature crop a period of from a year to 16 months elapses, according to the climatic conditions of the locality. In the Mackay area, for instance, it is 12 months, but around Bundaberg, further south and with lower temperatures, it is 16 months.

During the first months of the life of the crop constant cultivation is necessary to eradicate weeds, but the need for this slackens as the crop develops and disappears completely as the cane grows high. Harvesting in the Mackay area is spread over a period of six months from June to December, during which, in September and October, the cane attains its highest sugar content, 16%. At the beginning and end of the harvest season it is not more than about 11% and falls rapidly away if the cane is left standing after December.

Before the fields are cut they are fired to destroy the trash or dead leaves that envelope the cane stalk from bottom to top and make a canefield almost impenetrable. This makes harvesting easier, though dirtier, and, incidentally, scares away the snakes which infest canefields. It, however, imposes upon the farmer the necessity of cutting the cane no later than 24 hours after it is burned, since fired cane deteriorates rapidly if it is left standing.

Harvesting is complicated by the fact that cane, once it is cut, deteriorates rapidly, with the consequence that the quantities cut and delivered each day to the mills must be as close as possible to the capacity of the mills to handle it. To that end district inspectors carefully watch the ripening crops and estimate from time to time the tonnages which the mills must be prepared to handle daily if the harvest is not to extend to a point where the cane cut has lost most of its recoverable sugar content. After the first season's growth the cane is harvested as the ' plant ' crop. In the second and third seasons the stools send up new shoots known as the first and second ratoons. The yield diminishes each season and it is not usual to grow more than two ratoon crops, after which the old stools are ploughed out, the land is rested for a season and a new crop put in.

Before the harvest begins the farmer selects a paddock of his best cane to provide the setts for the next crop. Sometimes it is stripped while standing, but it is considered safer to cut and strip the stalks as they are required for setting. Stripping of the leaves removes the protective sheath from around the node, or eye, which could be killed or badly damaged by a sharp frost.

Cane cutting

Cane cutting is still largely done by hand and it is strange that, although efficient harvesting machines have been evolved for many crops from potatoes to cotton, and although the production of a mechanical cane harvester has occupied the attention of engineers and inventors since the turn of the century, no completely successful harvester has yet emerged. Dif-

ferent models are produced from time to time, each one ironing out one or more of the faults of its predecessors, and it is thought that within 10 years a machine will be developed that will enable the mechanisation of the sugar harvest. Some recent examples of mechanical harvesters are the Fairymead, the Kinnear, the Maloney and the Toft, all devised and manufactured locally.

In the hand harvesting of cane, cutters contract for the work in much the same way as shearing teams contract for sheds in the wool industry, and in much the same way they follow the cane from district to district as it comes in. It is hard and dirty work, but it is well paid. On present rates the cutter receives an average of £A33 for a 40-hour week. He uses a short, heavy broad-bladed knife, almost as large as a butcher's chopper. Ten tons of cane is regarded as an average day's work for one man; this includes cutting the cane, lopping the green top and loading it on to transport.

The bulk of the cane is, however, usually loaded mechanically by hoists and grabs and is carried to the mills on long cane trucks drawn by small locomotives. The light, narrow 2 ft. 6 in. gauge lines are moveable and are shifted from paddock to paddock as the cane is cut in successive areas. Two thousand miles of light railway line, 200 locomotives and 31,000 cane trucks are provided by the millers to bring in the cane. Large quantities are also delivered by the Government railways and by road haulage.

Sugar mills

The sugar mills are situated as close as possible to the canefields, which in most cases stop only at the outskirts of the plants. Pleystowe Mill, some five or six miles out of the city of Mackay, is one of the seven that handle the district's cane. Standing in about 70 acres of land, with 150,000 sq. ft. of roofed plant, it provides outstanding amenities for its employees, including 36 staff cottages, to which the mill supplies fuel, power and electric light. Pleystowe's intake averages 100 tons of cane an hour and is probably double the planned capacity; this has been reached only by constant experimentation by engineers and technologists. The production of cane in the Mackay area has grown in the past 20 years by over 100,000 tons a year, while the post-war objective of the industry, 1,250,000 tons of raw sugar a year, was reached in 1953, a year ahead of schedule. This great increase over the pre-war yearly total of 900,000 tons is handled by substantially the same plant, although its increased capacity has been brought about by considerable expenditure on extensions.

A single-row mechanical harvester in action. Its two slanting arms guide the cane to two circular knives which cut it just above the roots; the propellor whirling in the circular shield above lops the tops, and the stalks are laid in a line behind the machine as it moves along

Milling procedure

On arrival at the mill each cane truck passes over a weighbridge and is tagged with the owner's number. Its contents are dumped into a moving steel-ribbed conveyor that takes it through two sets of cane knives before it is fed into the crushing plant. The crushers consist of single mills. Some plants have four mills, some five, some six; Pleystowe has five. The cane is crushed in the mills, the fibre emerges as 'bagasse,' the juice running away through pipes at the base of the mill. As each crushing removes only about 60% of the sugar content of the cane, the bagasse is macerated in each succeeding mill, either with water or with the juice of another mill, to extract further sugar. Travelling on a moving steel belt, it passes through the five mills and emerges from the fifth after 95% of its sugar content has been removed.

The bagasse is carried straight on a conveyor belt to the furnaces, where it is used to raise steam to drive the mill machinery and to evaporate the juice.

After being purified by the addition of an automatically controlled quantity of slaked lime, the juice is steam-heated to a temperature of 216°F. as an aid to coagulation. In Bach subsiders immediately above the heaters the solidified impurities sink to the bottom and the clear juice is drawn off at the top and sent to the evaporators, where the sugar content of the juice is raised from 15% to 70%.

From the evaporators the liquid, now known as syrup, passes to vacuum pans to be boiled until sugar crystals are produced. The mixed mass of syrup and crystals, called ' massecuite,' is then transferred to a crystalliser, where the crystallisation continues. Finally, the raw sugar is separated from the syrup, now called molasses, in centrifuges.

One of the small locomotives which are a feature of the cane country arriving with its load at Pleystowe mill

Loads of cane, each marked with the number allotted to the farm of its producer, waiting their turn at the entrance of the crushing plant of Pleystowe mill

Refineries

The refineries of the Colonial Sugar Refining Co., universally known simply as ' C.S.R.,' are established in all Australian capital cities. At them the raw sugar from the mills is refined for human and industrial consumption. At present the C.S.R. Co. is embarked on a programme of expansion in its refineries that will, when complete, cost £A4 million.

By-products

Molasses, the exhausted syrup from raw sugar manufacture, is finding increasing use as stock feed and fertiliser. It is also raw material for the distillation of methylated spirit, rum, industrial spirits and power alcohol.

At Sarina, about 30 miles from Mackay, the Australian National Power Alcohol Co. produced 2,500,000 gal. of power alcohol during 1952-53. It employs over 100 men. Drawing its supplies of molasses from raw sugar mills in an area stretching from Burdekin in the north to Mackay in the south, this plant absorbs an average of 1,400 tons of molasses weekly. It also produces, from the yeast cultures used in the fermentation process, a high concentrate of vitamin B complex, which is marketed as ' Vegemite.' The plant uses 53 rail tankers, each of 3,000 gal. capacity, to transport molasses from the mills and has storage capacity of 46,500 tons.

Treacle and golden syrup from the refineries are rich in natural foods contained in raw sugar; by-products of distillation are carbon dioxide gas, used in aerated drinks, and dry ice. Recently a £A3 million factory was built in Sydney, in New South Wales, to turn sugar-produced alcohol into cellulose for making various plastic products.

Finally, the filter mud, the solidified impurities of the cane juice that are removed during milling, is used as a fertiliser in all cane districts, besides being the source of cane wax for the making of polishes, copying carbons and similar products.

The sugar export agreement

In December 1949 Australia entered a long-term export agreement with the United Kingdom regarding sugar. At present this agreement terminates on December 31, 1959, but provision has been made for its yearly extension so that, if found mutually advantageous, it may cover a further continuing period of eight years. The main provisions of the agreement are:

(1) A market for 300,000 tons of Australian sugar yearly will be assured in the United Kingdom at a guaranteed price to be negotiated each year, which will ensure a reasonable return to efficient producers.

(2) A further 300,000 tons of sugar yearly will be marketed in the preferential markets of the United Kingdom and Canada at a price equivalent to the world market price plus a preference.

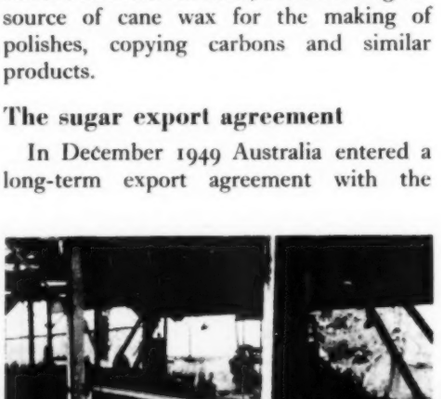
In addition to this international agreement, internal tripartite agreements for the production and disposal of sugar have been made for five yearly periods between the Australian Commonwealth Government, the Government of the State of Queensland and the sugar industry and can be summarised as follows:

(1) The Commonwealth Government agrees to prohibit the importation into Australia of any foreign grown sugar.

(2) The Queensland Government agrees to make refined sugar available in sufficient quantities to meet Australian requirements (a *per capita* consumption of 120 lb. a year) and at a uniform wholesale price in all capital cities;

(3) The sugar industry agrees to carry the risk of loss on exports and also agrees to contribute a fixed sum, at present £A216,000 a year, to the Fruit Industry Sugar Concession Committee.

This last clause, which has cost the industry £A4 million in the last 16 years, enables the makers of jams and canned fruits to sell in competition with other countries and to pay orchardists a higher rate for their produce.



Cane being delivered into the carrier at the mill, on its way to the crushing mills

The Bureau of Sugar experiment stations

The help and advice of the Bureau of Sugar experiment stations, a branch of the Queensland Government Department of Agriculture, is available to all growers and millers, who finance it by a levy of 4d. per ton on all cane grown. Agricultural experiments and the breeding of cane varieties are carried out at three field stations in the Cairns, Mackay and Bundaberg districts, while milling experiments take place at a number of selected mills.

(*continued on page 74*)

Mediterranean Grassland and Fodder Research

DR. R. O. WHYTE
Food and Agriculture Organisation

Great interest attaches to the efforts sponsored by FAO to improve the fodder resources in the Mediterranean region, thereby increasing the food production in that characteristically under-nourished area. The following account of the present position has been provided by Dr. R. O. Whyte, at present attached to FAO and a member of the FAO working party.

THE development of grassland management and fodder production in the countries bordering the Mediterranean took a marked step forward when the delegates to the Second Meeting of the FAO Working Party on Mediterranean Pasture and Fodder Development, held at Algiers from April 28 to May 2, 1953, agreed to collaborate in a research programme. Since that meeting approval has been obtained for the details of such a programme covering, in the initial stages, eight of the main problems affecting the Mediterranean.

1. Regeneration of natural vegetation by protection from grazing, fire or other use

Throughout the bio-climatic regions there is need for more information on the effect of protection on the ecological succession of over-used or misused vegetative cover. The objective of experiments would be to find the correct rate and duration of stocking per unit area which will at the same time permit optimal regeneration and improvement of the cover. The rate of regeneration will probably be slow in semi-arid conditions, more rapid under higher rainfall; on the other hand, succession in the latter conditions and in certain vegetation types may tend to pass the stage of optimal grazing and fodder production to a less economically valuable shrub and tree stage, which may nevertheless be of greater conservation value.

2. Reseeding of natural grasslands and shrub vegetation

The speed of regeneration of the plant cover on deteriorated range may often be considerably accelerated by reseeding, with or without previous controlled burning, and/or water spreading, and/or application of fertilisers. Correct techniques for reseeding have yet to be determined for many Mediterranean areas; success may ultimately depend on the availability of true Mediterranean strains of herbage species.

3. Measurement of present and potential conditions and carrying capacity of range

In order to facilitate comparisons between experiments made in different ecological environments, even within the relatively uniform Mediterranean region, the meeting in Algiers considered that an attempt should be made to standardise methods for the determination of range condition, forage productivity and carrying capacity. It is hoped to set up a special study group to survey existing methods and make recommendations on this difficult problem.

4. Rotations incorporating legumes or other fodder crops, particularly under semi-arid conditions

In order both to increase the total fodder resources in amount and to improve their quality, everything possible should be done to break the characteristic cereal/fallow rotation and to grow a greater acreage of fodder crops and pastures in arable rotations. The development of forms of alternate husbandry specially adapted to Mediterranean conditions of climate, farming systems and land tenure will not only contribute to the fodder resources and to the maintenance of soil fertility, but will also make it possible to reduce the pressure of livestock numbers and therefore the overgrazing on the uncultivated land.

It will be extremely difficult if not impossible to depart from the cereal/fallow rotation in rainfalls below 300 mm. per annum. With suitable species under favourable conditions it may be possible to introduce legumes into rotations where the rainfall is between 300 and 400 mm., but this must be tried with due care. Above 400 mm. considerable progress should be possible.

5. Fodder reserves

The establishment of reserves of conserved fodder must necessarily be a primary

A pastoral scene in the Pyrenees

objective throughout the Mediterranean area (a) to facilitate the maintenance of a reasonably uniform level of nutrition throughout the year, (b) to be prepared for seasonal fluctuations in production, and especially drought years and consequent periods of shortage, and (c) to assist in reducing the pressure on natural grazing lands by providing conserved fodders which can be fed elsewhere during certain times of the year, when natural grassland should be protected from grazing. Conservation under Mediterranean conditions must therefore visualise safe preservation for at least five years.

Reserves can be built up by conservation of good quality fodder crops, using the usual methods of haymaking, ensilage or artificial drying; high quality feeds may be diluted with straw to meet the needs of low quality animals. Standing reserves in the field on arid and semi-arid rangeland may be natural vegetation which has regenerated following protection or planted fodder trees and shrubs producing fruit and foliage beyond the reach of animals.

6. Observations of adaptation of species, varieties and strains of herbage and fodder plants in uniform Mediterranean nurseries

During the summer of 1953 FAO built up a central pool of seed samples obtained by purchase or by requests to seedsmen, plant breeders and others; in addition, delegates to the Algiers meeting agreed to contribute 1 kg. of seed of the chief herbage and fodder species and strains found to be of value in their respective countries. These samples, some 200 in all, have been subdivided into approximately 50 gm. samples and distributed to the following nurseries:

Country	*No. of Nurseries*
Israel	2
Cyprus	1
Greece	2
Italy	2
Egypt	2
France	1
Spain	2
Portugal	1
Morocco	2
Algeria	1
Tunisia	1
Turkey	1
Total	18
Libya	2 (partial)
Yugoslavia	3 (partial)

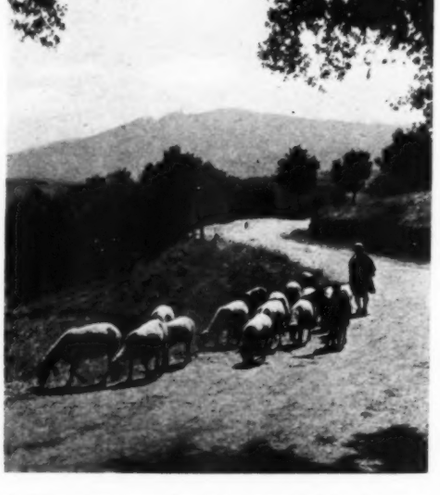
In addition, complete or partial sets have been issued for nurseries in Iraq, California and Chile (other countries with a Mediterranean climate). It will be possible after the first two or three years to eliminate many non-adapted species and strains and to carry the promising types into larger trials. The uniform Mediterranean nurseries will continue to provide a mechanism for the initial observation of the new types which will progressively become available from plant collections made within the Mediterranean, from plant introductions from other parts of the world and from the plant breeding stations.

7. Adaptability and yield of introduced grain and fodder sorghums

Trials in Israel have indicated the great superiority of some of the newer American varieties of sorghum as compared with the local types. Although some doubts were expressed at the Algiers meeting as to the applicability of these results throughout the Mediterranean, steps are being taken by FAO to obtain seed for trial in the spring of 1954 in those countries interested in collaborating.

8. Seed-production characteristics of promising grasses and legumes

The development of the Mediterranean research and production work will greatly depend on the availability of seed of adapted herbage and fodder species. FAO will do everything possible to promote seed production within the area by providing information on the agronomic and harvesting techniques and by encouraging seed trade interests to enter this quite undeveloped and unco-ordinated field of Mediterranean agriculture.



Goats grazing by the roadside in the Pyrenees

Recent developments

Since the second meeting of the working party in Algiers, progress has been made along other lines of research. In the first place Dr. D. A. Boyd of the Statistical Department, Rothamsted Experimental Station, has spent some time at FAO headquarters preparing experimental designs for the trials on rotations, reseeding, fertiliser application and comparisons of varieties of legumes, sorghums and other potential pasture and fodder plants. These plans will be submitted to the collaborating countries for consideration prior to a full discussion of the design and interpretation of experiments at the third meeting of the working party in May 1954.

Dr. H. G. Thornton, head of the Soil Microbiology Department of Rothamsted Experimental Station, is collaborating with FAO in providing the necessary inoculum for the uniform Mediterranean nurseries. Arrangements are also being made for more complicated trials to be conducted in two or three countries in the region.

This experiment will compare the local adaptation of effectivity of nodule bacteria, using strains obtained from the Mediterranean region itself and also from the United Kingdom, the United States and Australia. Although it is generally stated that the necessary strains of nodule bacteria are available in most parts of the Mediterranean where legumes are likely to be grown, it is believed that fundamental research of this type might yield very interesting and economically important results.

In addition, tentative arrangements are in progress with authorities in Australia whereby it may be possible to obtain the services of a qualified officer to collect indigenous pasture and range species within the Mediterranean area. The joint aim of FAO and the Australian authorities would be to establish these indigenous ecotypes in special observation plots adjacent to some of the uniform Mediterranean nurseries. The ultimate objective would be to select and develop strains of desirable adaptability, growth type and other characteristics and to arrange for seed to be made available through normal trade channels for experimental and practical purposes both in the Mediterranean countries and in Australia.

The further development of the Mediterranean and other FAO regional range, pasture and fodder programmes will reflect the emphasis being given to their close relation to the improvement of animal husbandry. It is already an axiom that the grazing and browsing animal is the most valuable tool in the hands of the improver of grassland and pasture management. It

Sheep grazing in Greece. In the background is Mount Parnassus

is also obvious that the nature of the fodder and grazing resources, their seasonal availability, protein/carbohydrate level and ration, etc., govern the type of livestock and the form of animal husbandry which can be maintained. High grade dairy cattle cannot be maintained at a uniform level of nutrition through a long, dry summer without irrigated pastures or fodders. Sheep can be maintained on the semi-arid rangeland of North Africa only if the extreme seasonal and annual variations in rainfall are met by the provision of adequate fodder reserves. Increasing attention is therefore being given to both the demand and the supply sides of the balance sheet; improvements in both must go hand in hand if a stable form of animal husbandry is to be evolved, based on a reliable and uniform supply of high or adequate quality grazing, fodder, crop residues and concentrates.

The Mediterranean research and development programme is only in its initial stages. For the first two or three years a few of the collaborating countries will start work on each of the ten main lines of research. But gradually the picture will become more complete, all the ten items will be studied somewhere in the region and the results will be made available to the whole group. Thus through co-operative activities under the guidance of FAO the Mediterranean countries are beginning to tackle the most important, most neglected and most difficult problem of their winter rainfall, summer drought environment.

Photos : P. 59, 60: French Government Tourist Office; p. 61: Greek Information Office.

Australian Farming Notes

Western Australian wheat crop

The Government Statistician estimates that 36,900,000 bushels of wheat for grain will be harvested this season from 2,800,000 acres in Western Australia. This is an average of 13.2 bushels per acre. Although the area is less by 200,000 acres than the previous year, when 35,500,000 bushels were produced from 3 million acres, the 1953-54 average yield is expected to be greater by 1.4 bushels per acre. A slight decrease is forecast in the area of oats for grain, but the harvest has been estimated at 11 million bushels (as compared with the 1952-53 figure of 10,400,000 bushels from 832,000 acres). The current oats harvest would come from 791,000 acres, with the anticipated average yield per acre being 13.9 bushels against 12.5 bushels for the previous season. Wheat and oats cut for hay are expected to yield 240,000 tons from 200,000 acres, averaging 1.2 tons to the acre. In the previous season 205,000 tons came from 175,000 acres.

Rhizoctonia

South Australian cereal crops will suffer considerably if the disease rhizoctonia continues to spread as it has done in the past few years, the Murray Mallee Agricultural Adviser, Mr. W. H. Brownrigg, has stated. Rhizoctonia was very severe in barley and there appeared to be nothing that could be done about it at this stage. Mr. Brownrigg suggested that a change-over from cereal growing to sown pasture in the badly affected areas might improve the cereal-sick soil and starve out the disease.

Grain shipment difficulties

The general manager of Western Australia's Co-operative Bulk Handling Ltd., Mr. H. E. Braine, estimates that 20 vessels will be needed to clear all old-season wheat from that State. At November 17, however, only three ships were in sight and prospects for more were not bright. Additional ships were also required in December and January to clear new grain. Mr. Braine said that the problem of finding storage for the State's grain would be difficult. To a total storage capacity of 45 million bushels the company was adding at terminals another 7 million bushels. However, the effective storage capacity was less. Mr. Braine said that the position may be better next year. By that time overseas stockpiles should have gone into consumption and wheat may be flowing steadily from Western Australia. Also the Albany terminal should be ready for operation. It will provide storage for another 1,300,000 bushels. As soon as this is completed, the company plans to begin the construction of a modern terminal at Geraldton. When this is complete it will have storage space, including its annexe, for 4,800,000 bushels. Western Australia will then have modern terminals at every port.

Research farm yields

Ten bag wheat crops and rich pastures grown on 11 in. of rainfall have been recorded at South Australia's Minnipa Research Farm. Last year the average wheat yield at the farm represented almost 3 bushels to the acre for every inch of rain that fell. The manager of the farm, Mr. H. R. Day, stated that wheat yields had increased almost 30% since Barrell Medic and Wimmera ryegrass pastures had been sown on the farm and encouraged by top-dressing. Farmers were becoming more soil fertility conscious and wider rotations, with a restorative period of pasture between cereal crops, was becoming accepted farming practice.

The Tropics as Sources of Vegetable Oils and Fats

SIR HAROLD TEMPANY, C.M.G., C.B.E., D.Sc., F.R.I.C.

OILS and fats can be divided into those of animal origin and those of vegetable origin. The former include butter, lard, stearine, tallow, whale oil, the fish oils, etc.; the latter comprise the fixed oils derived from a very large number of plants, of which about 13 have attained great commercial importance.

Vegetable oils can be subdivided into (*a*) edible oils, which include groundnut, cotton-seed, soya-bean, sunflower and olive oils, all used mainly for food; (*b*) edible-industrial oils used for food and for making margarine as well as for soap-making and other industrial purposes: they include coconut, palm and palm-kernel oils; and (*c*) the industrial oils which include those with drying properties, used for paint and varnish manufacture, *e.g.* linseed oil and tung oil, and those, such as castor oil and rapeseed oil, which are used as lubricants.[1]

Formerly animal oils and fats were of greater importance than vegetable oils, but of late years the position has become reversed and vegetable oils predominate, largely as a result of the development of refining and hardening processes which enable processed vegetable oils to be employed where animal oils were formerly exclusively used.

Production and trade in oils and fats

It is believed that the total world production of animal and vegetable oils of all kinds is in the region of 22 to 23 million tons annually. Of this, animal fats account annually for about 6 to 7 million tons, or approximately 30% of the total, while vegetable oils account annually for 16 to 18 million tons, or approximately 70% of the total. The position in regard to world trade is given in the following table, which is taken from a Commonwealth Economic Committee publication:

TABLE 1

TOTAL TONNAGE OF OILSEED CROPS ENTERING WORLD TRADE IN TERMS OF OIL EQUIVALENT

		Tons
Pre-war	Average for the years 1934-38 ..	4,226,000
Post-war	1948	2,814,000
	1949	3,284,000
	1950	3,755,000
	1951	3,853,000

This is a shortened version of the Leverhulme Memorial Lecture delivered before the Liverpool Section of the Society of Chemical Industry in April 1953. It is reproduced with the permission of the Society from its journal CHEMISTRY AND INDUSTRY.

Total export production has risen steadily since the war, but by the end of 1951 had not yet attained the pre-war average. The export shortage has been to a considerable extent compensated by increased production in some of the importing countries. It is of interest to ascertain which regions of the world are the largest producers of vegetable oils.

TABLE 2

APPROXIMATE TOTAL PRODUCTION OF OILSEEDS BY CONTINENTS

(*in thousands of tons of oil equivalent*)

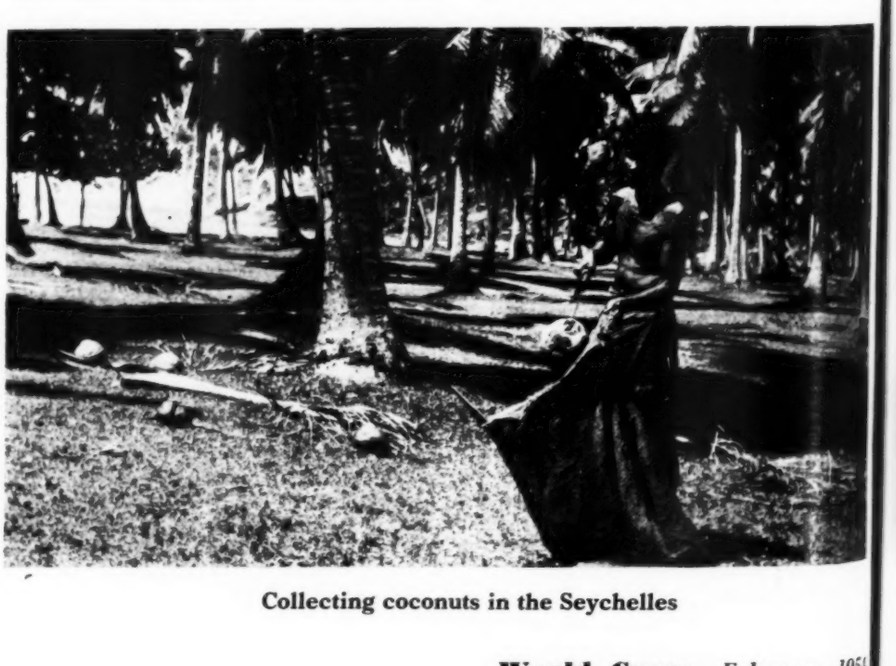
	1934-38 (mean)	1950-51
Europe	2,160	2,210
Asia	8,180	8,320
America ..	2,460	3,765
Africa	1,910	2,100
Oceania ..	180	160

Asia has always held the predominant position; the Philippines, Indonesia, India, Ceylon and Malaya produce the bulk of the world's supplies of coconut oil; Indonesia and Malaya were formerly the largest export producers of palm oil, while India and China produced the largest quantities of annual oil seeds such as groundnuts, sesame and castor. Consequently, when the Philippines, Indonesia and Malaya were occupied by the Japanese large supplies were thereby cut off from the Western world, thus creating a difficult situation.

It was feared that the war would result in wholesale destruction of plantations of coconuts and oil palms in these countries and serious permanent shortages would occur. Actually, these fears proved over-pessimistic and the rate of recovery of vegetable oil and fat production exceeded expectations. According to FAO, world production in 1952 was about 11% higher than the average for the years 1934-38; on the assumption that during this period world populations increased by 10%, *per caput* availability of vegetable oils and fats is slightly above the pre-war average.

External factors affecting the position

These include a number of political and other factors: *e.g.* difficulties over ex-



Collecting coconuts in the Seychelles

TABLE 3

ESTIMATED TOTAL PRODUCTION IN TERMS OF THOUSANDS OF TONS OF OIL EQUIVALENT

Annual crops	*Mean* 1934-38	1948-49	1949-50	1950-51
Groundnut	2,750	3,130	3,165	3,150
Cotton seed	2,450	2,090	2,360	2,180
Soya beans	1,840	2,375	2,110	2,655
Sunflower	630	1,065	1,080	1,140
Sesame	750	815	810	785
Linseed	1,150	1,295	1,145	1,085
Rapeseed	1,350	1,620	1,715	1,745
Castor	220	225	240	250
Total	11,140	12,615	12,625	12,990
Tree crops				
Coconut	1,575	1,350	1,425	1,535
Palm	810	780	885	925
Palm kernel	365	335	365	385
Olive	880	480	1,135	580
Tung	120	130	135	135
Total	3,750	3,075	3,945	3,550
Grand total annual and tree crops	14,890	15,690	16,570	16,540

TABLE 4

NET AMOUNTS OF OILSEEDS ENTERING WORLD TRADE IN TERMS OF THOUSANDS OF TONS OF OIL EQUIVALENT

Annual crops	*Mean* 1934-38	1948	1949	1950	1951
Groundnut	805	480	530	500	440
Cotton seed	190	80	118	145	110
Soya bean	380	70	264	255	415
Sunflower	32	70	30	113	110
Sesame	68	29	35	28	23
Linseed	610	212	257	410	450
Rapeseed	52	17	27	36	55
Castor	85	102	82	128	95
Total	2,222	1,060	1,343	1,615	1,698
Tree crops					
Coconut	1,040	930	1,005	1,050	1,275
Palm	437	366	488	506	435
Palm kernel	315	308	347	372	340
Olive	134	74	41	146	65
Tung	78	76	60	76	40
Total	2,004	1,754	1,941	2,150	2,155
Grand total	4,226	2,814	3,284	3,765	3,853

change; fluctuations in price; food subsidies; the effects of food rationing and control over exports. These have all affected the position, while the reappearance of Western Germany as a country of considerable import consumption is noteworthy.

Another factor is the production of soapless detergents, which expanded during and since the war. These are in some cases made from oils and fats, but they are also made from mineral oil; in the latter case they can represent considerable savings of vegetable oils.

Sources of vegetable oils

Vegetable oils and fats fall into two categories: (*a*) those produced from annual crops and (*b*) those produced from permanent or tree crops. The most important among class (*a*) are groundnut, cotton-seed, soya-bean, sesame, sunflower-seed, rapeseed, linseed and castor; among class (*b*) are olive, coconut, oil palm (producing palm oil and palm-kernel oil) and tung oil.

There are a number of oil-yielding plants other than these of appreciable commercial importance, although their production is not so great. Disregarding these, the bulk of the production is made up of the kinds already mentioned. The estimated annual production of each is shown in Table 3.

The corresponding figures for the amounts of each oil entering into world trade are given in Table 4.

Oils from annual crops form a much larger part of total production than do the permanent tree crops. On the other hand, when it comes to the amounts entering into world trade, the position is reversed and permanent tree crops occupy the first place, coconut oil taking the lead.

The second point is the extent to which supplies of vegetable oils are derived from tropical countries.

Of the annual oil crops, four, namely cotton seed, groundnut, sesame and castor, are grown only in the tropics and sub-tropics. Soya beans and sunflowers are temperate crops, but can be grown under a wide range of climatic conditions. The production of tropical annual oil seeds represented last year 42.5% of the total; before the war it was, however, 61.7% of the total, showing that as a result of the war there has been a marked increase in the production of annual oilseeds in temperate countries.

In the case of oils from permanent crops, the major part of supplies come from the tropics, and indeed the only non-tropical crops in this category of commercial importance are olive oil, which is, of course, a product of countries with Mediterranean type of climates which may be described perhaps as almost sub-tropical, and tung oil, of which the part derived from *Aleurites fordii* comes from warm temperate regions, while that from *A. montana* comes from countries with tropical climates.

Yields of oil per unit area

Table 5 shows the average oil contents of the principal oil crops, the average yield per acre under present conditions and the average potential yield of oil per acre.

Some conclusions

It is probable that to the tropical countries the world will look in an increasing degree for supplies of vegetable oils. It is true that in some temperate countries production of oils and fats has increased considerably. Nevertheless, bearing in mind (*a*) that increased production of oils in temperate countries may entail decreased production of other equally badly needed crops, (*b*) that large areas of uncropped land still exist in parts of the tropics and (*c*) that much of the land at present cropped is cultivated by smallholders using primitive methods which give small returns, it seems reasonable to conclude that the tropics offer the greatest scope for the extension of oilseed production. Moreover, it also seems that the tree crops and particularly coconuts and oil palms may be the most promising sources of increased supplies, by reason of the large returns per unit area they can give.

The figures given for production of coconut oil and palm oil per acre must not be regarded as the limit to the possibilities.

In Indonesia, for example, it has been shown that, under favourable conditions and using selected seed for planting, yields of palm oil of up to 2 tons per acre can be obtained. On the other hand, the growth of tropical permanent crops imposes limitations, *e.g.*, the length of time before plantations come into bearing, usually at least four years.

It was probably considerations of this type which directed attention to the cultivation of groundnuts rather than to oil palms and coconuts and the inauguration of the East African groundnut scheme. It is certain that annual oil-seed crops will always be grown on a large scale. It seems, however, likely that the consumption of them will lie more and more in the producing countries themselves. Thus India, formerly the largest exporter of groundnuts, last year exported only 30,000 tons, although production is estimated to have reached 3,347,000 tons. The principal source of groundnut exports at present is Nigeria, but here, too, with growth of population, domestic consumption is likely to increase.

Cotton seed is a by-product of cotton cultivation and production depends on the area cultivated, which in turn depends on the demand for cotton in the world's markets. It does not seem likely that cotton production will expand greatly in the near future, although all the cotton seed at present produced is not processed.

Sesame is widely cultivated as a smallholder's crop in China, India and Africa. Little attention has so far been paid to its improvement or the mechanisation of its cultivation and harvesting; the oil content of the seed is high, exceeding 50%, but yields are low. Work on breeding new varieties is in progress in Venezuela and in the U.S.A., and this may lead to increased cultivation.

Annual oil seeds which can be grown as summer crops in temperate latitudes and as cool-weather crops in the tropics include soya beans, sunflowers and linseed. They have not so far been grown on a large commercial scale under tropical conditions.

Permanent crops

In the circumstances the future appears to lie largely with permanent crops, particularly with coconuts and oil palms, although it is possible that other palms, *e.g.* species of Attalea in South America, may also ultimately become important sources of supply. It seems desirable to deal with these two crops at a little greater length.

Coconuts

The coconut is one of the most versatile plants and uses are found for a large number of products from the tree; the principal product is, however, coconut oil, contained in the endocarp of the nut, which is dried to make copra, from which the oil is extracted by pressure.

TABLE 5

Crop	*Product*	*Oil content (%)*	*Average yield of seed (lb.), etc., per acre*	*Potential yield of oil (lb.) per acre*
Tropical annual crops				
Groundnut	Kernels	48 of kernels	700	336
Cotton seed	Seed cotton	20 of seed	660	133
Sesame	Seed	51 ,,	400	204
Castor	Seed	46 ,,	450	208
Temperate annual crops				
Soya bean	Seed	17 ,,	700	119
Sunflower	Seed	50 ,,	800	400
Linseed	Seed	37 ,,	500	185
Rape	Seed	42 ,,	900	368

Crop	*Product*	*Oil content (%)*	*Yield of product (lb.) per acre*	*Yield of oil (lb.) per acre*
Tropical tree crops				
Coconut	Copra	68	1,330	904
Oil palm	Fruit	25	5,000	1,250 } 1,397
	Kernels	49	300	147 }
Tung oil (*Aleurites montana*)	Seed	39	2,000	780
Temperate tree crops				
Tung oil (*A. fordii*)	Seed	—	—	400
Olive	Fruit	30	2,000	600

The palm grows only in tropical climates and does best on light, easily permeable soils, with slowly moving subsoil water at a shallow depth. It can, however, grow well on heavier soils provided they are well drained. The ideal conditions are usually found in the coastal regions, and cultivation is almost exclusively confined to them; there are vast areas of coastal land throughout the tropics that could be used for coconut cultivation.

At present the bulk of the supplies come from smallholdings of Asiatic or African native cultivators. There are, however, also numerous estate plantations ranging in size from 100 to many thousands of acres; the largest is believed to be in Portuguese East Africa and to extend over some 40,000 acres. The total area under coconuts in the world has been roughly estimated to be between 9 and 10 million acres, but the figures are largely conjectural.

The countries of largest production are, in order of importance, as follows: the Philippines, Indonesia, India, Ceylon and Malaya, followed by the Pacific Islands, Indo-China, Thailand, East Africa, West Africa, South and Central America and the West Indies.

Yields of copra per acre may vary greatly; they depend on the characters of individual palms and the treatment they receive. Yields of nuts vary from 140 or more per tree per annum down to 10 to 15 nuts or less. The size of nut and the meat and oil they contain also greatly vary. The yield in terms of oil per acre may range between 1,600 to 1,700 lb. per acre down to, say, 300 lb. per acre. There are a number of varieties of coconut, but according to Child,[2] the total certainly does not exceed 30. Yielding capacity is an inheritable quality; the palms are propagated from seedlings raised from mature fruit. It is important that planted nuts should come from prolific trees.

The extension of coconut cultivation holds out possibilities of making available additional supplies of oils and fats on a large scale and there seems to be ample land which could be drawn on.

Oil palms

What has been said with regard to coconuts applies also to the African oil palm (*Elaeis guineensis*). This palm is indigenous to tropical Africa and occurs in profusion in the part of West Africa known as the palm belt. The pericarp of the fruit is rich in oil while the kernels of the seeds also yield oil which closely resembles coconut oil. African natives have for long extracted the pericarp oil by crude methods for local use and for export; palm kernels were extracted by hand and exported as such, but little attention was paid to the care of palm groves, while the produce was of poor quality.

The palm was long ago introduced into the Botanical Gardens in many tropical countries, but its cultivation as a commercial crop was not undertaken until the first decade of this century by the Dutch in Sumatra, where an industry developed

rapidly, exclusively on plantation lines. In 1939, before the last war, exports of palm oil from Sumatra were the largest in the world and amounted to 226,000 tons, exceeding shipments from Africa by several thousand tons. Malaya also developed the growing of oil palms on plantation lines somewhat later, but by 1939 exports amounted to 60,000 tons of oil.

Developments were facilitated by early provision for scientific services in Indonesia and in Malaya. The work of Heusser and Rutgers, in Sumatra, and of Georgi, Bunting and Milsum, of Malaya, were of outstanding value in solving problems of cultivation and extraction.

There are many varieties of oil palm, the main differences consisting in the thickness of the shell and the oil-containing pericarp. In Sumatra and Malaya thin-shelled types were isolated which were well suited to local conditions; these bred reasonably true and are used for propagation.

In Africa in the British dependencies, oil-palm production has remained predominantly a native industry, depending mainly on the exploitation of the indigenous palm groves. British policy, in accordance with the conception of the dual mandate, has resisted the creation of estate plantations and concentrated efforts upon improving native methods of production from the trees in the palm groves. An important step forward has been the introduction of mills for the improved extraction of palm oil, a step which the United Africa Co. were instrumental in starting. It was resisted for a time by the native producers themselves, but is now giving results—upwards of 140 ' pioneer mills,' as they are termed, having been erected.

Estate development in British West Africa has been minimal, the total plantation area amounting only to 20,000 acres, of which 6,000 acres lie in the mandated territory of the British Cameroons, and the balance in South Nigeria.

By contrast, great developments have occurred in the Belgian Congo under a system which combined utilisation of the largely untouched natural groves with the development of plantations by an organisation known as Les Huileries du Congo Belge (H.C.B.). The results have been striking. In 1951, production of palm oil in the Belgian Congo was in the region of 200,000 tons, while shipments reached 130,000 tons; when developments started they were non-existent.

Other tree crops

Olive oil is produced mainly by smallholders in the Mediterranean region where Spain, Portugal and Italy are the most important countries of production. A recent development has been large-scale plantings in Argentina and Mexico, while the crop is also grown in California as well as in South Australia.

Yields on the average are lower than for coconut and palm oil. Features of the olive crop are the long time that elapses before trees come into bearing and the great fluctuations of yields from one year to another. It is a matter for speculation whether, with improved facilities for irrigation, the fluctuations in yield may not be evened out and production expanded.

Tung oil is mainly used in paint and varnish manufacture. It is derived from two species of *Aleurites*, of which one, *A. fordii*, is grown in warm-temperate climates, and the second, *A. montana*, is fully tropical. Formerly, it was only produced commercially in China, but today *A. fordii* is grown extensively in the United States and Argentina. The cultivation of *A. montana* was attempted before the war in Assam, Burma, Indo-China and Indonesia; today an effort is being made to encourage cultivation in Nyasaland, while similar efforts are in progress in the Belgian Congo, French West Africa and Madagascar.

Numbers of other trees possess potentialities as sources of oilseeds, including certain palms in South America, but these are not cultivated on any scale. A species which has attracted attention of late is the South American oil palm (*Elaeis melanococca*) which resembles the related *E. guineensis* but has certain advantages, *e.g.* a procumbent habit which makes harvesting easier and greater resistance to some diseases. This has been introduced into West Africa and the Congo and attempts are being made to raise hybrids between it and *E. guineensis* which may have superior characteristics.

Discussion

The immediate world-supply position for vegetable oils and fats is better today than was expected immediately after the last war. Nevertheless, demands are bound to expand as populations grow and long-term agricultural policies must take this into account.

The tropical regions hold out the greatest promise as sources of future additional supplies, and the tropical palm crops, coconuts and oil palms hold out the best promise of high returns. The vast stretches of coconuts in the Far East and the extensive oil palm plantations in Indonesia, Malaya and the Belgian Congo demonstrate the possibilities. But if these exist, there are also limitations to their exploitation. Successful development demands skilful agricultural techniques, the existence of capital resources and provision of scientific services to cope with the various problems, combined with administrative and commercial services to secure the effective working of the enterprises. Moreover, permanent crops involve a long wait between the time the crop is planted and the first harvest. On this account small peasant producers tend to be attracted to short-term annual crops, except in so far as the expense of planting permanent crops

A typical palm oil plantation in East Sumatra

can be met by growing intercalary annual crops.

It follows that, if the potentialities are to be realised, large-scale working is essential. On the other hand, plantation working is becoming more and more difficult, partly because of the difficulties of obtaining sufficient labour and also more and more by reason of the increasing tendency towards nationalism and the preference of local administrations for development in large numbers of independent smallholdings rather than as large estate units. In British territories, and especially in West Africa, this has been accepted as part of official policy. By contrast, in the Belgian Congo, Government policy has been favourable to large-scale development. It seems inescapable that if the problem of increased production is to be solved it is impossible to rely solely on uncontrolled indigenous native producers, unaided by outside resources. One solution may be the uniting of large groups of native producers into co-operatives or collectives, controlled by a central authority with powers to enforce working in accordance with prescribed methods. An outstanding example of this was the successful building up of the cotton industry in the Sudan Gezira. Another possible solution is the development of plantations on a limited scale, working side by side with a peasant proprietary and purchasing produce from them for processing in estate factories. This method has been successfully applied in cane-sugar cultivation in many tropical countries.

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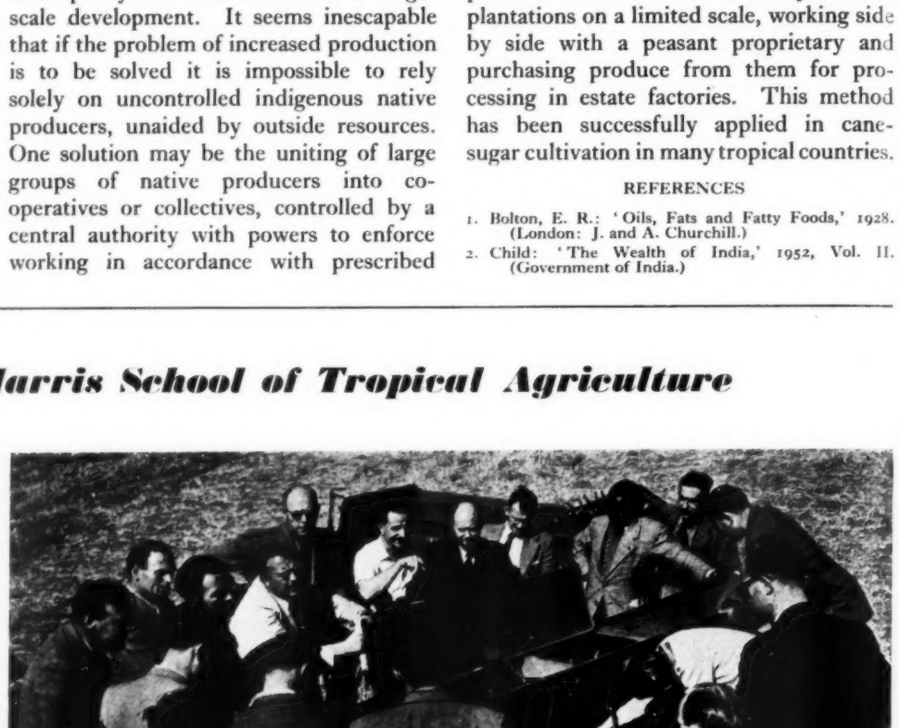
The Massey-Harris School of Tropical Agriculture

Massey-Harris Ltd. runs a school for tropical agricultural officers, and last year the course was held at the Essex Institute of Agriculture, Writtle. The purpose of the tropical agricultural equipment course is to show the Colonial agricultural officers, or indeed anyone interested in mechanising undeveloped areas, the machines which are available and their proper place in any agricultural programme.

In order to cover the widest range of cultural requirements possible, the company brought machines from its factories in the United Kingdom, Canada, France, the United States and South Africa. The instruction on this equipment included an explanation of the work done in the temperate zone and also wherein it was thought to be of interest in tropical areas. For instance, the work done by a stubble mulching machine used in Canada and the United States was exhibited as a possible deterrent to soil erosion and excessively high soil temperatures which may bring about soil sterility. Another instance was the mechanical damming device to tie ridges at intervals of 7 to 10 ft. Tying ridges is a traditional practice of the native farmer in many parts of Africa and a highly desirable one where rainfall is torrential in nature. Its purpose is to stop heavy run-off and consequent soil erosion.

Other types of machines included those of special interest to rice growers, such as scrapers for use with agricultural tractors for constructing dams; border discs for building water levees; a water pump with an output of 2,000 gal. per min. attached to a field tractor. These, with all types of rice tillage tools, were demonstrated by constructing a small rice field which was flooded from a nearby river. Shown in rowcrop tillage were planters for planting groundnuts, cotton, maize, peas and beans both on ridges and the flat. A special machine which builds a ridge and plants on it in one operation was of great interest to men from the groundnut areas, as well as a twin row planter planting two rows spaced 6 in. apart at 36 in. centres. This method of planting groundnuts not only increases the plant population but is thought to retard infection with Rosette disease. Two types of spring weeders and both two- and four-row cultivators with a wide variation of ground tools followed the planting demonstrations.



A grain and fertiliser (or rice and fertiliser) drill is discussed by one of the classes

In all, nine types of wheel tractors in four power classes ranging from 20 to 60 D.B.H.P. and 34 types of Massey-Harris tillage, planting and harvesting machines were demonstrated.

To round off the instruction so that all phases of mechanised agriculture would be included, other companies were invited to join with Massey-Harris, and the following subjects were added:

Use of sprays for insecticides, fungicides and hormone weed control; servicing and care of rubber tyres; instruction on the purpose and means of obtaining good lubrication; machines used in swamp drainage and land reclamation; tropical crop storage. All these subjects appeared to be of great interest to the classes, the members of which came from 33 different colonies and countries.

The new site of the course—The Essex Institute of Agriculture, Writtle—provides the best in accommodation and instruction facilities. The reaction of those in attendance last year indicated that the subjects were vitally interesting and most helpful to them. It is now planned that this two weeks' course shall again be held this year.

Co-operative Grass Drying in Relation to Dairying in the United Kingdom

DAVID LE ROI, B.Sc.

In this article, the author discusses the development of grass drying in the United Kingdom in its relation to the production of concentrated feeding stuffs for the dairy farmer in replacement of imported feeding stuffs.

GOOD grass is the ideal milk-producing diet for the milch cow, but fresh grass is abundant and at its best only in the summer months; in winter, dairy herds must, of necessity, depend upon dry fodder, cereals and oil-seed cakes for the bulk of their food. Unfortunately, the greater part of winter feed used in this country is not only deficient in certain essentials to good nutrition, but a large proportion has to be imported. Poor feed in winter is responsible for low milk yields. Indeed, when averaged over the whole year, the present diet for dairy cattle tends to be lower in protein and considerably more bulky than it was before the Second World War. Consequently, average milk yields of herds in Britain are much less than they would be if better attention were paid to feeding, particularly in winter.

Until 1939, nearly 9,000,000 tons of foodstuffs were annually imported into Great Britain. During the war years these imports were reduced to an average of 1,300,000 tons. By 1948, imports had been restored to approximately 25% of the pre-war total, but it is doubtful if they will reach more than a third of the 1939 figures within the foreseeable future.

Comparison between the diet of the dairy cow before and since the last war shows that in 1939 the average milch cow in Britain consumed approximately 75 cwt. of purchased concentrates. By the end of the war the purchased concentrates per cow had dropped to 10 cwt., while the total annual ration per cow, including fresh grass, had increased to 98 cwt. Over the same period the ratio of protein to total feed dropped from 1-4.8 to 1-6.6. In other words, the wartime and post-war cow has had to eat a greater quantity of food containing less milk-producing elements than did the pre-war animal. As a consequence, the milk yield per cow was reduced by 10%.

Although the feeding position has shown some improvement over the past few years, it is still far from satisfactory. A higher proportion of protein and a less bulk of fibre are essential if the average milch cow is to yield the quantity and quality of milk of which she should be capable.

Grasslands

Yet, if scientifically utilised, the crop from our existing grasslands can provide economically and throughout the year a large part of the protein so obviously lacking in the present cattle diet. Improved farming of British pastures is undoubtedly the most important single step that could be made to the easing of the present dairy feedstuffs situation, and agricultural scientists are agreed that a substantial increase in the crop output of the existing grassland is both practical and economic.

Approximately 10,500,000 acres are devoted to cultivated grassland in England and Wales. Test fields have proved that in many districts it would be possible to increase threefold the normal grass yield of 42 cwt. of fresh grass per acre. It must be remembered, however, that any increase in the yield of grassland would naturally occur in the normal grazing season when there is frequently a greater crop than the herd can consume from pasture. The grazing season can be extended both early and late by reseeding and fertilising, but even so nothing spoils rich pastures so seriously as under-grazing. Consequently, in a good season, mowing has to supplement grazing to prevent waste of grass and deterioration of the sward itself.

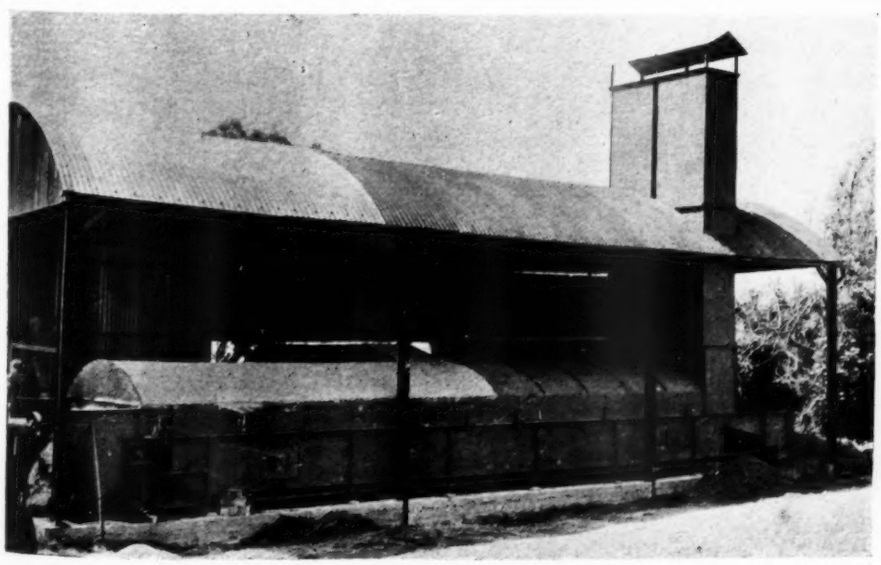
Grass conservation

Mown grass has to be conserved as hay, silage or dried grass. In the making of hay, much of the carotene is lost by oxidation. Fresh grass contains a minimum of 30 microgrammes of carotene per 100 g. of solid matter, whereas the maximum carotene content of hay is only 10 microgrammes of carotene per 100 g. of solid matter. Good quality silage is richer than hay in carotene and may contain as much as 50 microgrammes per 100 g. of solid matter, but it is poor in vitamin C and D, both of which are essential to the health of the cow and to the quality of the milk she yields.

Dried grass

Artificially dried grass is equal to the best quality silage in carotene content and is particularly rich in other necessary vitamins and minerals. Moreover, the natural colour of dried grass after it has been processed is pleasing to the dairy farmer and, if it is properly stored, the colour is maintained and is appetising to the cow.

Cows fed 5 to 10 lb. of dried grass per day yield more milk during the winter



A stationary conveyor drier in typical installation

months, and the milk is of the colour and quality of summer milk. Moreover they breed more regularly and they are less liable to many of the bovine diseases. Table 1 shows the relative nutrition values of dried grass and comparable feed crops.

TABLE 1

Crop	*Yield per acre*	*Starch equivalent per acre*	*Crude protein yield per acre*
		lb.	lb.
One crop of hay from temporary leys	28 cwt.	1,100	280
One crop of hay from permanent grassland	20 cwt.	670	170
Dried grass (three cuts)	50 cwt.	3,400	820
Grass silage (three cuts)	12 tons	2,700	700
Dried lucerne (three cuts)	60 cwt.	3,270	1,340
Wheat	18 cwt.	1,500	250
Oats	16 cwt.	1,100	190

History of grass drying

About 20 years ago Dr. H. Woodman discovered that grass dried with hot air was not only preserved from decay but that the very high food value of fresh grass was effectively conserved. In 1927, a bulk sample of grass was successfully dried at Billingham and during the next five years several driers were designed with the object of drying grass on a commercial scale, but it was not until 1933 that a reliable drier was developed by Imperial Chemical Industries. Little progress was made during the following six years, but after the outbreak of war in 1939 all the driers then in operation were working to full capacity. By 1948, the annual production of dried grass had reached over 100,000 tons and has since steadily risen.

Economics of grass drying

It is seldom worth the cost and labour involved to dry grass from unfertilised grassland. High protein grass is grown by fertilising leys or permanent grassland with a liberal amount of phosphate and potash and then applying 8 to 12 cwt. of nitrogenous fertiliser at intervals during the summer. An acre cut several times during the summer will yield 2½ to 3 tons of good quality dried grass.

Approximately two-thirds of the milch herds in Great Britain consist of an average of 14 cows or less, and in the case of these small dairy farmers the cost of labour and plant for grass drying would be uneconomic. To cater for the dairy farm requiring only comparatively small quantities of dried grass a number of co-operative grass drying centres operated by the Milk Marketing Board is provided.

The Milk Marketing Board

When the Milk Marketing Board was established in 1933 its sole concern was the marketing and distribution of milk. From this it was but a natural step for the board to seek ways and means to help dairy farms to increase efficiency in milk production. During the war the board foresaw the ultimate need for larger quantities of home-grown concentrates, and the possibility of providing dried grass on co-operative lines was thoroughly explored. In this the board had the assistance of farmers who had operated grass drying plants since 1936 and also valuable help from organisations in the Netherlands, Switzerland and Scandinavia, where co-operative grass-drying schemes had been in operation for a number of years.

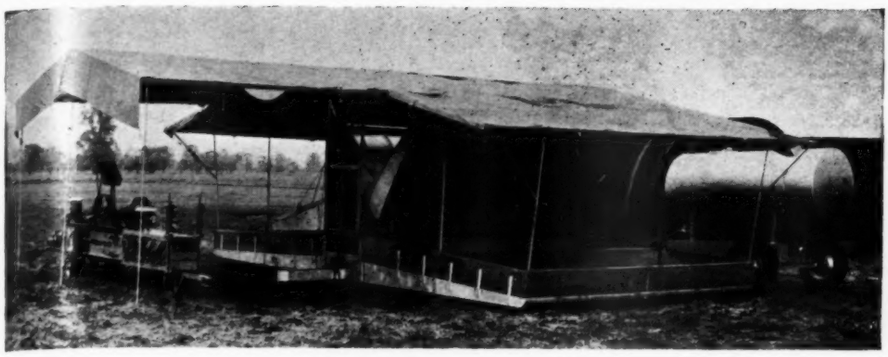
In 1947 the Milk Marketing Board initiated the first co-operative grass-drying centre in Great Britain, and since then has developed farm grass drying into a co-operative service for both small and large consumers. The board provides the capital involved and undertakes to cut, cart, dry and deliver the grass.

Each drying centre has two or three driers serving some 50 farmers. The board provides fertilisers and distributes them at a contract price. The grass is collected by the board's transport, dried and returned to the farmer in numbered bales analysed for crude protein content. Careful costing records are kept and the organisers are able to study each item and assess the effect of new methods and equipment. To maintain close touch with the users of dried grass each centre has an advisory committee of local members. Not only does the board operate co-operative grass-drying centres but it encourages groups of farmers wishing to set up their own co-operative centres. Already many of these are in operation.

The establishment of co-operative drying centres

The first essential to consider before establishing a co-operative grass-drying centre is whether there will be a plentiful supply of grass for drying throughout the season. Subject to certain variable factors, a total of 400 acres of good grassland cut once, and up to 600 acres of lower-grade land, provide sufficient grass to keep one 4 cwt. per hour drier in full operation

Chopped dried grass issuing from the cyclone of a high-temperature drier



A portable tray drier assembled and ready for work

during the growing season. If the fields are to be cut twice the above acreage can be halved.

Factors which must be taken into consideration are the estimated yield per acre at the various dates on which the grass is to be cut, the drier's output in relation to the moisture content of the grass sent to it and the number of days on which labour can be provided for operating the plant.

Rain is responsible for a day-to-day variation in the amount of grass dried, and in a wet season the output will be seriously affected.

Choice of site for drying plant

The selection of the site for a drying plant demands careful consideration. It must be as central as possible to the area from which the bulk of the grass is expected to come. In a region of many streams and rivers the plant must be sited in relation to existing bridges. Capital costs are considerably reduced if the plant can be erected on a well-drained, level site. It is essential that electricity, telephone and mains water are available and that local supplies of electric current are adequate for operation of the plant.

Power requirements

Power requirements for a drier rated to produce up to half a ton of dried grass an hour are about 170 h.p. In terms of electric current this is approximately 120 kW.

Types of driers

Grass driers are of two main types; those which dry the grass in long form, that is lifted after cutting, and those which dry the grass after it has been cut into 1 in. lengths. Long form driers may be subdivided into tray driers, which deal with the grass in batches, and conveyor driers, which provide continuous drying. Machines that dry the grass in chopped form are termed pneumatic driers as the grass is dried while it is blown across the heating agent. Pneumatic driers have the great advantage that their capacity to evaporate moisture from the grass can be increased by using higher temperatures when the grass is exceptionally wet. This maintains a more constant output of dried grass and renders the plant less dependent on weather conditions.

Fuels

Coal, coke and oils are the fuels most commonly used, oil being the most convenient from the point of view of stoking. But it is expensive and except in small plants its high cost is seldom offset by economy in labour. At current prices the difference between the solid and oil fuels is approximately £2 per ton.

Cutting, transport and packing

Most co-operative grass-drying centres find that it makes for greater efficiency if the plant provides the equipment for cutting the grass and transporting it to the driers rather than relying on individual mowing and transport by members. Consequently capital costs must include the purchase of tractors and mowers, lorries and trailers for collecting wet grass and delivering it dried, and the various implements for clearing and fertilising fields where the centre undertakes these tasks.

The cheapest method of packing dried grass is baling, and if an automatic string-tying baler is employed one man can bale the whole output of the plant. Power requirements for this type of packing is approximately 10 h.p. One disadvantage of baling is that dried grass is not as resilient because of its low fibre content as hay or straw. Consequently, baled grass leaf is inclined to crumble, but this broken material is highly nutritious and is generally acceptable to farmers when collected and returned in sacks.

Dried grass may be sent out in the form of meal but although this is convenient for feeding to poultry and pigs, it is not so palatable to cattle as dried grass and is difficult to feed. Moreover, the cost of milling and packing is high and its power requirements are considerable. Alternatively, dried grass can be turned into cubes, but the cost is considerable. Cubing machinery can, of course, be used for other work such as cubing farmers' cereals.

From a general point of view, however, and particularly during the first two or three season's operations, baling the dried grass is probably the most satisfactory and economical method.

Capital costs

The capital required to establish a co-operative grass-drying centre varies considerably, but a typical tray drier to handle 8 cwt. an hour entails a capital expenditure of £9,600, while the cost of a conveyer drier handling the same amount of grass would be £13,000. These figures include costs of site, buildings, plant and vehicles. To justify these costs the centre would require to produce approximately 900 tons of dried grass in the season. Capital grants amounting to one-third of the approved capital costs are available from the Ministry of Agriculture. Any society availing itself of a grant must agree to operate the centre for a period of not less than four years.

Before proceeding with the setting up of a co-operative grass-drying centre, approval must first be obtained from a number of authorities. And it is important that sufficient time be allowed for these formalities to be completed if it is desired to start operating in any particular season.

Conclusion

The cost of dried grass does not solely depend upon the efficiency of the drying centre. It depends in large measure on the skill of the farmer in producing high quality grass suitable for drying throughout the months of April to October and upon partially drying the grass naturally by allowing it to wilt on the field without spoiling its quality. With the scientific growing of suitable grass and the continued development of drying technique, it ultimately should be possible to produce in this country all the protein foods necessary to the wellbeing of our milch herds.

Photos : National Institute of Agricultural Engineering.

Grass Output

The influence of soil fertility on grass output, a subject which has become of great importance to the farmer and to the nation, was the theme of a recent meeting of the British Grassland Society, held in London. Prof. P. A. Linehan presided.

The Seventh Meeting of the Conference of FAO

THE seventh meeting of the conference of FAO was held in Rome at the headquarters of the organisation on November 23 and following days. The conference, in effect, is the supreme authority of the organisation and includes the representatives of all the member states. In earlier years it met annually, but later it was decided, by reason of the great expense involved and also because in ordinary circumstances yearly meetings were unnecessarily frequent, that meetings should take place biennially. The last meeting of the conference was held in 1951, an account of which appeared in WORLD CROPS, Vol. 4, pp. 13 and 61.

The present conference was specially important inasmuch as it marked the termination of the period of appointment of the present Director-General, Mr. Norris E. Dodd, and the appointment of his successor was one of the major tasks with which the conference was confronted.

The agenda of the conference included (1) routine procedural matters, such as the election of officers, the appointment of commissions and committees, etc.; (2) the review of the world situation and outlook for food and agriculture; (3) the review of the activities of the organisation; (4) certain constitutional and legal questions; (5) matters relating to the administration and finance of the organisation; and (6) new appointments and admissions of members to the organisation and to Council, of which there are a number, as well as the election of a chairman of the Council, and of a new Director-General.

Memoranda on various aspects of the work of FAO as well as the reviews of the state of food and agriculture in the world had been placed in the hands of members before the meeting.

As on the previous occasion, the work of the conference was for convenience divided into three commissions, of which Commission No. 1 was concerned with the world outlook for food and agriculture. Commission No. 2 dealt with the technical work of FAO; on this occasion it was further subdivided into a series of panels, each dealing with some specialised aspect of the work of FAO. Commission No. 3 dealt with legal, administrative and fiscal matters involved in the operation of the organisation.

The opening session

The conference opened at 11 a.m. on November 23, when the retiring Director-General, Mr. Norris Dodd, addressed the meeting. In the course of his remarks he gave a broad outline of the organisation's development during the past decade, five years of which had been under his general direction. During that period the membership of the organisation had steadily increased, while its tasks were ever widening. He emphasised the necessity for stabilising the programme of the organisation and of recognising that in attacking the basic social and economic problems of the world, only integrated and balanced programmes of operation can succeed.

After the Director-General's address Sir Donald Vanderpeer reported the nomination of Mr. U Thet See (Burma) as chairman of the conference and Messrs. Abdel Sidky (Egypt), F. W. Bulcock (Australia) and Ramon Beteta (Mexico) as first, second and third vice-presidents of the conference. These and other appointments to various committees of the conference were approved.

The second plenary session

At the second plenary session an address was delivered by Dr. Josue de Castro, the independent chairman. He discussed the progress made by the organisation since the sixth session of the conference and emphasised the desirability of establishing the Emergency Famine Reserve which had been proposed to help persons, and particularly children, in countries which have insufficient nutritional resources.

The report of commision

In its report to the conference Commission No. 1 commented on the marked increase in food production which had occurred during the past two years and was now 23% larger than before the war. The rate of progress was, however, very uneven; thus America, with only 7% of the world's population, now accounts for 20% of the world's agricultural production.

They concluded that (1) in the underdeveloped countries the programme seems inadequate to achieve the increase of production aimed at and (2) that a considerable shift of emphasis in financial provision and programmes may be desirable in some countries. Thus there are indications that in some cases there is too much emphasis on expanding areas cultivated and too little on increasing yields.

Appointment of the new Director General

The conference appointed Dr. Philip V. Cardon to succeed Mr. Norris Dodd as Director-General and re-elected Dr. Josue de Castro as independent chairman of Council.

The New Director of FAO

Dr. Philip Vincent Cardon, who has been appointed Director of the Food and Agriculture Organisation in succession to Mr. Norris E. Dodd, was formerly Administrator of the Agricultural Research Section of the United States Department of Agriculture. He was born at Logan, Utah, in 1889, at the Agricultural College of which state he received his early training and took his degree. He also holds the degree of Master of Arts of the University of California and is an honorary Doctor of Philosophy of Utah and Montana State Colleges.

He has wide experience of research and administration, has travelled widely in Europe and the Americas and has had intimate contacts with the work of FAO from the time of the Hot Springs conference in 1943, which was the prelude to the foundation of the organisation. He will be the third Director of FAO, his predecessors having been Mr. Norris Dodd and Sir John, now Lord, Boyd-Orr.

WORLD CROPS offers to the new Director-General its respectful felicitations on his appointment to this important office, coupled with best wishes for a successful tenure of office.

Christmas Acknowledgments

We have received, during Christmas, cards and calendars from the following:

Agricultural Engineers' Association, Mitchell Colman, Swingfire Ltd., Drake and Fletcher Ltd., Ford Motor Co., Joseph Pyke, International Harvester, Shell Petroleum, National Institute of Agricultural Engineering, May and Baker Ltd., A. E. Haarer, West African Oil Palm Research Institute, Salvat Editores of Barcelona, Dr. C. de Fellner, Rotary Hoes Ltd., D. P. Hopkins, Imperial Chemical Industries, R. C. Liebman, Leeford (London) Ltd., Pest Control Ltd., Monsanto Chemicals Ltd., Dorman Sprayer Co. Ltd., L. T. Sardone, Graham Cherry, Villiers Engineering Co. Ltd., Victor de Bellefroid, P. H. Southwell.

We acknowledge these with many thanks and at the same time take the opportunity of wishing all our readers a happy and prosperous 1954.

A Note on the Use of Plant Ashes in Native Agriculture in West Africa

F. R. IRVINE, Ph.D.

IN West Africa, plant ashes are widely used in local agriculture; when land is cleared for planting, the twigs, leaves and branches of naturally occurring trees and shrubs are usually burnt and the ash therefrom covers the soil. Clearing is usually done during the dry season and, although the ash must add something to the soil, it usually happens that the high winds which accompany the first rains blow much away, while the fertilising elements which remain are usually leached away by rain before crops can germinate.

Some examples

In certain cases, however, the ashes of particular plants are highly prized for their fertilising properties and are collected and used to fertilise crops. Among plants that are valued in this way is, according to Dalziel, the Baobab *Adamsonia*, of which the seeds and the bark are particularly rich in potash and phosphorus. They are used in West Africa as a fertiliser and also for the manufacture of the native crude types of soap. The ash of guinea corn (sorghum) is also regarded as highly valuable as a manure, while that of wild gourd (*Cucumis melo* var. *agrestis*) is known to be rich in potash and probably has value as a manure provided the ashes are returned to the soil immediately after burning.

The Imperial Institute examined the ash of the African tragacanth tree (*Sterculia tragacantha*), which is much employed in West Africa in soap making, and found that the ash from the leaves contained 12.26% of potash, while that from the wood and bark contained 18.50%. The wood and bark are therefore a more valuable source of potash than the leaves, although both compare not unfavourably with other plant products used in West Africa as sources of potash.

Practice in other parts of Tropical Africa

The use of plant ashes as a fertiliser is reported from a number of other parts of tropical Africa. Thus Baker records that the Nilotic Bari are accustomed to mix the ashes of bush fires with manure from their cattle kraals and use it for applying to the surface of their cultivated fields, which are hoed immediately after the application has been made.

In South Africa, the Ouambo farmers manure their farms yearly with the ashes of guinea corn (sorghum) stalks mixed with cow dung. From Northern Nigeria Meek reports that cow dung mixed with plant ashes is commonly employed as a manure on local farms.

Practice in India

In India, plant ashes have been used for various purposes for generations. Three main types of ash are recognised, *viz.*:

(1) Pearl ash, which contains predominantly potash salts.
(2) Barilla ash, which contains predominantly soda salts.
(3) Kelp, which contains predominantly potash, soda and lime salts of iodine and also bromine.

Of these, the only one with any interest for agriculture is No. 1, pearl ash. Sir George Watt, in his work, *The Economic Products of India*, lists some 35 species of plant of which the ash is used in India as pearl ash. Out of these 10 or more species also occur in West Africa and are used for the same purpose there. These include the ashes of banana and plantain skins, of the roots of the fan palm (*Borassus*), of the bulrush millet (*Pennisetum*) and of the weeds *Achyranthes aspera* and *Amaranthus spinosus*.

Soap making in West Africa

In making the crude West African yellowish or greyish soaps the ashes of a number of plants are used in conjunction with local oils, such as palm oil or shea butter, or oils obtained from the seeds of certain local plants, such as the tree *Pentadesma*. The analyses of few, if any, of the ashes so employed are known as yet, but as saponification with potash alkali produces soft soaps while soda produces hard soaps, and as, moreover, most local soaps lather very freely, the inference seems permissible that they are potash soaps and that the ashes from which they are prepared are preponderantly rich in potash salts.

Plant ashes in dyeing

In India, pearl ash is largely used as a mordant in dyeing, although rarely in a pure form, and at times the plants themselves are used. A large number of plants are used for the same purpose in the West African indigo dyeing industry and these are likely to be rich in potash; some of them provide ashes which are also used in soap making.

Plant ashes as a seed protectant

The use of mineral powders for the protection of stored seed against insect attack attracted some attention in Britain and America about a dozen years ago, and it is of interest to record that the late Mr. Lloyd Williams reported that in the northern territories of the Gold Coast it was customary for cultivators to mix the ash of the African dry zone mahogany tree (*Khaya*

Burnt grass and leafless trees in savannah country after a bush fire

senegalensis) with seed of millets stored for sowing in the next season in order to protect it from insect attack and preserve it in good condition.

Conclusion

It seems not unlikely that many of the plants and plant ashes used in soap making in West Africa may contain appreciable amounts of potash, and it may well be that they could be usefully employed as sources of that element for manurial purposes in gardens and on fruit trees wherever the use of potash is indicated, even though they may not be so rich in potash as the recognised commercial fertilisers.

European Timber Policy

For the first time in recent years governments of eastern and western European countries have agreed unanimously on a common policy for an important commodity—timber. Their representatives have recently concluded a joint meeting of two United Nations bodies, the Food and Agricultural Organisation's European Forestry Commission and the Economic Commission for Europe's Timber Committee.

To maintain timber supplies the delegates advocated the following measures: In the short run, to increase forest output by intensified silviculture, thinnings and the utilisation of wood waste and to increase imports of sawn softwood from the Soviet Union and other regions; in the long run, to extend afforestation and improve forest management in order to meet long-term increases in consumption. It will also be necessary to maintain wood at reasonable prices in relation to prices of other materials.

Timber requirements

These measures were considered necessary because demand for timber, especially pulpwood, and also to a lesser degree sawn wood, is expected to rise unless it is checked by excessive timber prices. Delegates warned that if production was not adjusted to the expected demand the gap between supplies and requirements would widen. Properly planned, fellings could be increased without damaging the forest; increased availabilities from eastern Europe and Canada were indicated; long-term afforestation programmes were already under way in some areas, and prices had recently come down, while the application of further technical improvements in wood production could reduce costs to the consumer without removing necessary incentives to producers.

Two demonstrations of spraying equipment for use against *Coelopa frigida*, the black flies which have been breeding in great numbers on the South Coast, were held recently at Brighton. The first demonstration was held by Swingfire Ltd., whose machines are seen in action above (*top*). At the second demonstration the Clean Crops machine was shown (*bottom*). Other companies whose product or machine was used at the second demonstration included Shell Chemicals Ltd., Swingfire Ltd., The Standardised Disinfectants Co. Ltd., Pest Control Ltd. and Pan Britannica Industries Ltd.

Forestry experts and timber traders from the 23 countries at the meeting believed that, by national action and international co-operation, the fullest use could be made of European timber resources to improve living standards for Europeans. Countries represented at the conference included Albania, Austria, Belgium, Canada, Czechoslovakia, Denmark, Finland, France, Federal Republic of Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Roumania, Spain, Sweden, Switzerland, United Kingdom, United States of America, Union of Soviet Socialist Republics and Yugoslavia.

A Correction

We have been asked to point out that, owing to an unavoidable mistake, the phrase 'rubber free fungicide' appeared in the January advertisement of The Standardised Disinfectants Co. Ltd. This should of course have read 'rubber tree fungicide.'

A New Agricultural Deal in Mexico

(From a Correspondent)

MEXICO has recently launched a long-range agricultural development programme that seems likely to have favourable repercussions on the national economy. The plan hinges on the efforts being made by the current administration to stem inflationary price rises and to increase buying power.

The ' emergency agricultural plan,' as it is called, has for its basis the increase of agricultural production, especially for such key crops as wheat, maize, beans, sugarcane and other food staples. But the long-term policy is to revise the structure of agricultural credit and to finance farming operations throughout the republic.

Agricultural credit

Through improved distribution of agricultural credit, including the establishment of new local credit institutions, Mexican farmers most needing aid will be directly benefited. The new co-operative credit agencies, with 20 members or less, will incorporate farmers tilling acreages of 10 hectares or less (around 22 acres). The widest possible latitude will be given by officials to enable them to incorporate all small farmers.

President Cortines has publicly stated that all new farm credit institutions will have the ' fullest freedom ' of action without being burdened by official red tape. They will be at liberty to admit new members, to exclude undesirables, to appoint and remove executive heads and to supervise the granting of loans and the collection of principal and interest under the direction of the Banco Nacional de Credito Ejidal (National Bank of Community Farm Credits).

Freed deposits

A recent government edict has released ' frozen ' deposits of private banking institutions. The ' freeze ' was ordered early in 1951 as an anti-inflationary measure; certain banks were compelled to place any increase in their deposits to the credits of their accounts with the official Banco de Mexico. This had the effect of limiting bank credits to the level they had prior to 1951, no matter how much the deposits had increased.

Bankers had been fighting this move from the start, and some months ago the government finally agreed to pay 6% interest on the ' frozen funds ' held by the Bank of Mexico. The granting of the ' unfreezing ' order has freed a total of 160,000,000 pesos (around $18,600,000) which banks may now lend to agriculture and industry.

According to the official ruling, at least 100,000,000 pesos ($11,630,000) must be apportioned for farm credits and the rest allotted to industry. This is in addition to a further 170,000,000 pesos ($19,760,000) in farm credits to be loaned to Mexico's farmers by the two federal institutions, the National Bank of Community Farm Credits (third largest state-owned bank) and the National Bank of Agricultural Credits (sixth largest state-owned institution in Mexico).

The total sum of 270,000,000 pesos ($31,390,000) is the largest agricultural credit ever made available in Mexico, and the feeling is that this will give a major impetus to production, correct the errors of the past, when the needs of small farmers were overlooked, and achieve a reduction in prices. The Asociación Nacional de Cosecheros (National Harvesters Association) has hailed the official move as a forward step that will assure the future development of Mexican agriculture. Already there is talk that this year's production of wheat, corn, beans, cotton, etc., will be doubled.

New agricultural land

This year will also see the opening of 300,000 hectares (roughly 750,000 acres) of new agricultural lands, most of this going under maize and beans. Secretary for Agriculture, G. F. Muñoz has said that the augmented production will materially reduce former deficits in the two staple foods of Mexico (tortillas and beans which provides the basic diet of the Mexican population). As a further stimulus to agriculture, growers will be guaranteed 500 pesos ($58) a ton for maize and 1,200 pesos ($151) per ton for beans harvested this year.

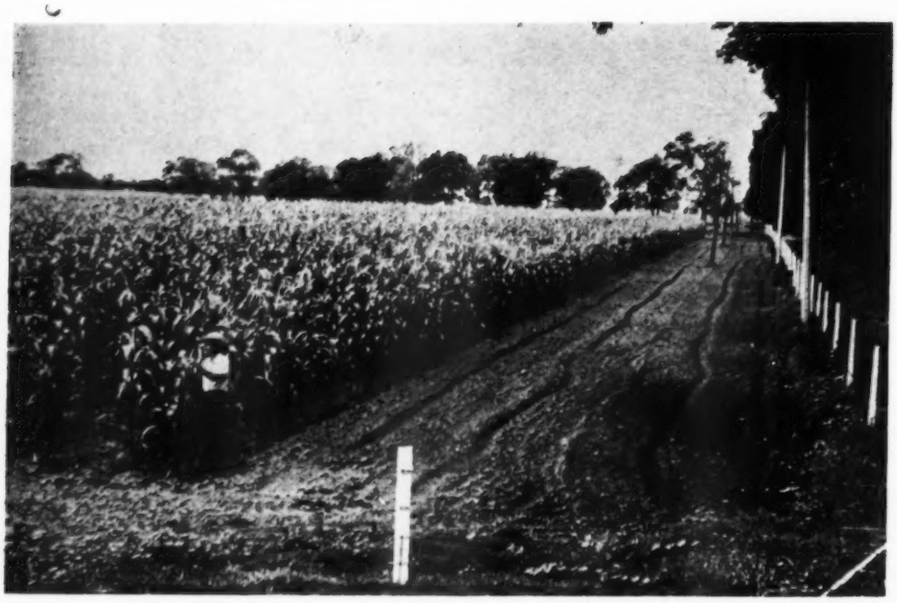
Banking circles in Mexico have hailed the release from ' sterilisation ' of the excess deposits which now can be utilised to encourage agriculture and industry. Banks are freed from the necessity of buying government bonds and, while the Bank of Mexico in a special bulletin warned that the new measure does not categorically release banks from placing excess dollar and peso deposits with the Bank of Mexico, it does give them freedom to extend credit operations in the fields of agriculture and industry.

According to the official Bureau of Statistics, Mexico now has 4,963,259 farmers. Of this total, 1,501,649 are members of *ejidatarios* (co-operative farm communities); proprietors of 5 hectares or less total 993,545; and 228,095 farmers have lands in excess of 25 hectares; 120,265 rent or lease farms, while 2,109,065 are peons, relatives and migratory farm workers.

Rural teachers

An important factor in the new agricultural plan are 60,000 rural teachers who have been mobilised by the government to

Careful records are kept in Mexico's agricultural experimental stations to see that the best possible information can be made available, without charge, to farmers



Corn is another basic commodity and the National Corn Commission has done useful work in the development of new seeds, adapted to various regions of Mexico. This experiment station is just outside Mexico City

teach farmers and livestock operators modern production methods. Special agricultural technicians of the Department of Agriculture are going to the field to instruct the teachers in the latest farming methods so that these in turn can instruct small farmers.

Mechanisation

Mechanisation of agriculture will also form part of the programme but the official view is that it is better to limit credits for the acquisition of farm machinery since there are vast areas of Mexico where, owing to topography or the resistance of older farmers, it is not advisable at present to attempt to introduce mechanised methods. It has been found that the banks have had losses by advancing funds for farm machinery purchases to community farmers not capable of managing or maintaining the equipment properly.

Co-ordination of agencies

The whole plan of farm credits and farming instructions will be co-ordinated with the interested agencies, including the farm credit banks, the Department of Agriculture and Livestock and the Department of National Economy, with the object of producing a smoothly functioning programme. Farmers, in addition to money and technical assistance, will have access to improved seed strains, fertilisers, information on markets, guaranteed prices and the security of sale of their harvests.

Directing this agricultural programme is a 12-member technical council including the Secretary for Agriculture, G. F. Muñoz, and the managing director of the National Bank of Agricultural and Livestock Credits.

Mexico has also tackled the problem of farm labour shortages within its borders and, sponsored by the Department of Interior and the Department of Labour, a new office has been created in Mexico City whose function will be that of a ' labour exchange,' which will regulate the movement of farm workers and attend to the supply of and demand for agricultural workers in the various regions of the republic. This move will tend to partially solve the problem of movement of migrant Mexican labour to the United States.

The fact that official agricultural and community farm banks will now have to act in strict compliance with the agricultural aims of the present administration, even if this means operating at a loss, should do much to improve the conditions of Mexican farmers. Farm credit organisations were first initiated in Mexico in 1925 when the federal authorities realised that there was an absolute need for special farm credit institutions, but there were many abuses and they did not work well. Today the 6,000 community farm groups in Mexico and many small-scale farmers trust that in future the agricultural credit provision will conform to the aims of the administration and will effect consolidation of the agrarian structure and the improvement of the farmer's lot.

Latest-type equipment is used on Mexican farms. The Department of Agriculture pre-tests mechanised equipment, and co-operative banks and private farmers purchase the ' proven ' machines

The Australian Sugar Industry

(*continued from page* 58)

A further station is being established at Ayr, in Queensland, while a sugar research station, financed and operated by the sugar mills, has recently been opened on the outskirts of Mackay. With a staff of sugar technologists, chemists and engineers, its estimated cost will be about £A50,000 a year; already it has effected a 20% improvement in the evaporation process and is now turning its attention to increasing the recovery of sugar from the solid impurities, or mud, and to ways of preventing and removing the scale that forms on the heating pipes of evaporators.

In addition, a great deal of research is done by the industry in the mills and fields. Those engaged in this work have formed themselves into a body called the Queensland Society of Sugar Cane Technologists, which meets yearly in conference to exchange information and views.

Conclusion

The remarkable development of the sugar industry is a story of romantic interest. It is a far cry since the first few fields of sugar cane were established in Queensland in the middle of last century. The success achieved is almost entirely the result of the energy and initiative of the Australian people themselves. The leaders in control of the industry realise that to retain and consolidate the advantages which they have won and to enable further progress to be made it is necessary to investigate every new line of possible development.

Article and photographs, courtesy of Australian News and Information Bureau.

The Use of Bagasse and Straw in Paper Manufacture

A. E. WILLIAMS, Ph.D.

The use of waste material from agricultural industries for making paper has attracted much attention of late years and below the author discusses the position in this regard of cereals, straw and sugar cane bagasse.

DURING the past few years there has been considerable development in the production of paper from waste materials, such as straw and bagasse. In practically all countries producing cereal crops there is a surplus of straw available for this purpose. In the United Kingdom, for example, between 7 and 8 million tons of straw are produced each year and, after allowing for direct agricultural uses, about 1 million tons are available for the paper maker. Bagasse is the fibre left after sugar has been extracted from the sugar cane; at sugar mills it is usually employed as boiler fuel, but often there is a large surplus from which paper pulp can be made. As a result, sugar mills are becoming increasingly interested in paper making and several of the largest throughout the world have already installed paper-making plant. For the manufacture of paper from straw, co-operative schemes have been evolved between farmers and paper mills, whereby the former undertakes to supply regular quantities of straw to the mills. Such schemes are in operation in several European countries.

New techniques

While the idea of making paper from straw and bagasse is not new, an impetus has been given to it by the introduction of a new technique which gives higher yields and a better quality pulp. Originally it was attempted to make paper from these materials by using the established methods adopted for wood pulp, the raw material for newsprint, but both straw and bagasse are much less dense than wood and this method of processing did not give satisfactory results. Nowadays, instead of using one process for converting the whole batch of raw material to pulp in one operation, a milder technique is used as a first stage, the more intractable material being mechanically rejected and afterwards re-treated. The pioneer of this improved method was Prof. Pomilio, an Italian scientist, who discarded the hitherto almost universally used method of digesting the raw material under pressure and introduced a technique whereby the material was digested at atmospheric pressure, followed by chlorination of the semi-pulp. This process was originally developed in Italy, but it has been much improved and modified by a British company, which has renamed it the Celdecor process.

A straw-cutting machine at work

Types of paper produced

Straw and bagasse pulp are now being used in different parts of the world to produce almost every type of paper. These pulps are versatile in application, but less so than long-fibred wood pulps. Wood pulps are naturally rather soft, but they can be made to produce a firm sheet by suitable beating, but straw pulp—which is naturally firm—cannot be made soft. For example, it is unsuitable for making the so-called featherweight printings which are characterised by exceptional bulkiness, or for blotting papers. When compared with writing or printing papers made from well-beaten wood pulp, in which the long fibres of the wood have been reduced in length, the strength of straw and bagasse papers is good, but, while wood fibres may be shortened, straw fibres, which are naturally short, cannot impart the characteristics of long fibres, the most important of which is high tearing strength. Because of this, straw and bagasse pulps are not widely used for making strong wrapping or tough ledger papers. When such pulps are employed in these papers it is always in conjunction with a long-fibred pulp to give strength. The main outlet for straw and bagasse pulps is in the production of printing and writing papers, corrugating material and board, while they can also be used for making greaseproof papers, glassine, tissues, packages for frozen foodstuffs and bleached solid white paper board.

Developments in India and elsewhere

Probably the most interesting bagasse development since the second world war has been the inauguration in India of a bleached bagasse pulp plant at the mill of Rohtas Industries Ltd. at Dalmianagar, in the province of Bihar. This plant commenced production in 1951 and has a rated output of 20 tons of pulp per day, which is used in the manufacture of fine papers and cigarette cartons. A plant operating with 20% straw and 80% esparto grass also came into production in 1949 at the works of Cie Nord Africaine de Cellulose in Algiers. This plant produces about 35 tons of pulp per day, which is used for making fine printing and writing papers.

The works of N.V. Maatschappij tot Stroveredeling 'Sove' at Arnhem, where a 40 ton per day straw pulp plant has recently come into production

A potential 12,000 tons per annum of straw pulp for paper making has been added to Europe's supplies through the installation of a new straw pulp plant at Arnhem, Holland. The pulp produced in this plant has been found most suitable for use in banks and bonds and in other papers where firmness is required. In Brazil, one of the largest sugar-producing companies, Refinadora Paulista, S.A., are completing the installation of a plant adjoining their sugar mill. This plant will produce 24 tons per 24 hours of bagasse pulp suitable for the production of fine printing and writing papers. It is being equipped with its own electrolytic plant for the production of caustic soda and chlorine used in the pulping process. In Mexico, a different situation is provided by an existing paper mill, Fabrica de Papei Coyoacan, S.A., Mexico City, seeking an additional source of pulp supply for the manufacture of fine papers. This is being achieved by the erection of a bleached bagasse pulp plant at a point convenient both to the paper mill and sugar mill. Another plant to start operations during 1953 is a combined pulp and paper mill at Felixton, Natal, South Africa, known as the Ngoye Paper Mills (Pty.) Ltd., which will produce about 20 tons per day. This plant will operate with bagasse supplied by an allied company.

Newsprint from bagasse

A good deal of publicity has been given to the possibility of making newsprint from bagasse and it is claimed that plants for producing newsprint from this material are under construction in the U.S.A. and that the cost of newsprint from this source will be much less than current newsprint prices. Somewhat naturally, these claims have received prominence in the newsprint-hungry newspapers of the world, but authorities in this field declare that it is necessary to sound a note of warning: newsprint is probably the most uneconomical of all the many types of paper which can be made from bagasse. Normal newsprint contains from 80% to 85% of wood pulp made mechanically by the process of holding the wood against a grindstone, without the use of any chemicals; this is the cheapest possible method of reducing wood to pulp. Bagasse, on the other hand, must be pulped chemically, and this inevitably puts up the cost.

Trial runs of newspapers printed on bagasse newsprint made in the U.S.A. and in Britain have given fairly satisfactory results and show that technically the difficulties are capable of solution. The economics of the matter are, however, another question and it seems unlikely that bagasse can ever form the basis of an industry producing newsprint in direct competition with newsprint made from groundwood. On the other hand, it may well be increasingly used for supplying local needs, especially where there is difficulty over providing currency for newsprint imports or where freight charges on normal newsprint are high. The use of bagasse for fine printing and writing papers, however, is subject to no such economic limitations and it is significant that in many of the new plants throughout the world installed for producing pulp from straw or bagasse the equipment is usually of British manufacture.

South African Crop Prospects

OUR correspondent in South Africa has sent us the following information on recent agricultural developments in the Union.

Fruit production

Towards the end of October exceptionally heavy rains fell over a wide area in the eastern Cape, where flood conditions were often present. After that there had to be assessment of the damage. An official of the Deciduous Fruit Board said that in the Koo area in the mountains of the Montagu district and in the De Doorns valley, both in the western Cape, the damage varied considerably from farm to farm. Some farmers reported that their whole fruit crop had been wiped out, but others whose farms were more protected had hopes that they would be able to save at least a portion of the fruit. In the Longkloof area which extends from George to Humansdorp, there were extremely heavy rains, but even in the mountains there was no frost, and the latest reports show that the damage there was negligible. It is too early to say what effect the frost will have on the fruit production of the Cape as a whole, but it is expected that exports will be affected.

Since bulk buying of deciduous fruit by Britain's Ministry of Food stopped three years ago, all exports from the Union have been sold by auction on arrival. This has meant better prices for producers of pears and apples, but the average prices of grapes, peaches and plums have been slightly below the former fixed prices. The return on apricots has remained almost unchanged.

Peach prices

A Peach Growers' Association of South Africa was established on October 28 at a public meeting at Ceres in the Cape. The executive committee received a directive to negotiate with the Food Canners' Council on the fixing of minimum prices for the new season's crop. The new association, the first to be set up by peach growers in South Africa, adopted a draft constitution largely based on that of the Apricot Growers' Association and with which it is intended that there should be the closest liaison.

Sugar prospects

Greatly improved conditions have been reported from the Natal sugar cane belt, where rains have relieved the anxious conditions of several weeks ago. The cutting season has now passed its peak and heavy deliveries of cane were made to the mills. The weight of the cane improved as a result of the cold weather and the rains and the sucrose content is stated to be high.

The favourable conditions now prevailing in the sugar industry are reflected in a revised estimate of an output of 720,500 tons of sugar for the present season, which represents an increase of 16,000 tons on earlier forecasts. In the 1950-51 season a record of 685,000 tons of sugar was produced and if the current estimate of this season is realised, it will be 35,500 tons higher than this satisfactory figure.

Deciduous fruit

At the annual Cape Western Province Fruit Farmers' Day at Bienne Donne, Groot Drakenstein, on November 5, the chairman of the Deciduous Fruit Board said that a survey showed that there had been no decrease in the rate of planting table grapes.

In 1949 there were 1,700 morgen of non-bearing vines that had since come into production. Since 1952 a further 1,700 morgen had been planted, all still to come into full bearing. Apples continued to be heavily planted and there had been an increase in the rate of pear plantings in recent years. A census of fruit trees taken at the end of 1952 planting season showed apricots at the top with 3,366,000 trees. Peaches were next with 2,877,000 trees and apples third with 2,204,000 trees. There were about 60,000 olive trees in the Union, mostly in the Cape.

Cotton Defoliation for Mechanical Picking

THE mechanical picking of cotton has become an accepted technique for reducing the cost of harvesting, but to gain this advantage effective defoliation has become essential. Many chemicals have been tried for this purpose with varying degrees of success, but have left a variety of problems to be solved. It was with such problems in mind that E. H. Karr and A. G. Ash, of the Pennsylvania Salt Manufacturing Co., of Washington, set out to develop a new defoliant more than three years ago. Their objective was a defoliant that was not dependent on dew, could be used under a wide variety of climatic conditions, was easy to mix and apply, and was not subject to fire hazard, soil toxicity or human toxicity.

The result of their work was a new magnesium chlorate formulation which was given the name ' De-Fol-Ate.' During the 1951 season, large field tests were carried out. They continued tests in 1952, but by then the product had proved successful enough to ensure a demand on a commercial scale.

A two-row cotton picker in an Arizona field which was defoliated at the rate of 10 lb. per acre

Field tests

Most of the field tests were conducted using the product as an airplane spray and proved out the features Karr and Ash had sought. ' De-Fol-Ate ' demonstrated its effectiveness in the absence of dews and at very low humidity. Containing a fire suppressant, it rendered cotton actually less inflammable under field conditions than untreated cotton.

Since it dissolves readily in water, it cut down mixing time and left no sludge in mixing tanks, and because of the absence of boron ' De-Fol-Ate ' could be used on soils in which the boron content was already near the critical point. One of the chief advantages, however, was that, while it gave the desired results, it accomplished them more rapidly than other defoliants.

Because of the hygroscopicity of the product, it was found that spray nozzles could be set for very fine droplets without fear of evaporation. These finer droplets were more effectively circulated by air currents to the lower leaves of plants.

Advantages of 'De-Fol-Ate'

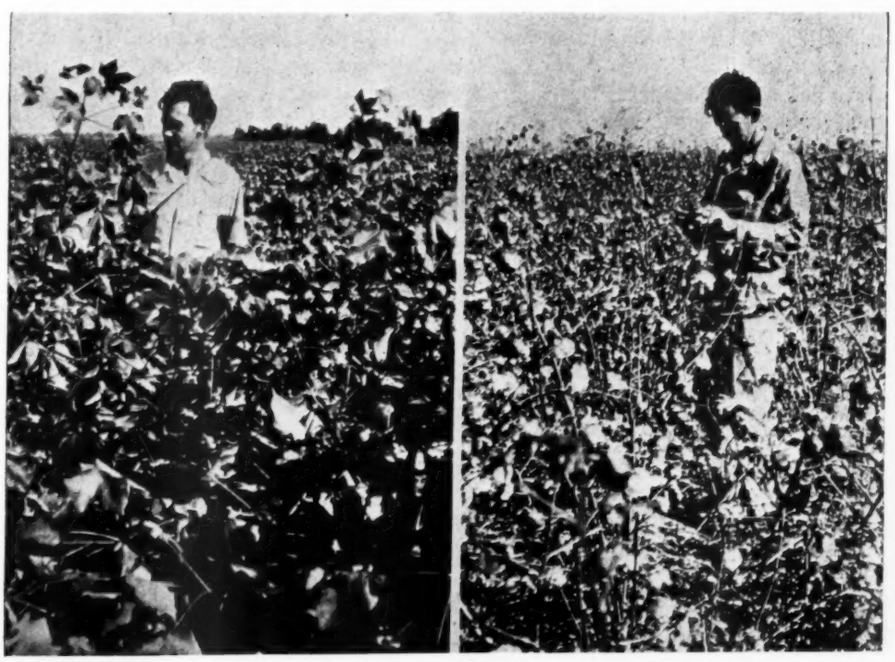
Growers and sprayers accustomed to using chlorate type defoliants have been using a spray of 10 gal. of water to 10 lb. of defoliant per acre as a matter of practice. While this is satisfactory, it has been found that, due to the much higher solubility of ' De-Fol-Ate,' a lower volume of water could be used to apply the same amount of material, thereby increasing the effective pay load of the plane and increasing the ratio of flying to filling time. It should be noted, however, that, in order to obtain coverage, spray nozzles must be set for finer droplet size for this concentrated material.

Under normal conditions, ' De-Fol-Ate ' should be applied at the rate of from 7 to 10 lb. per acre as a spray. Rank or lodged cotton may require 12 lb. per acre or two applications of 6 to 8 lb., the second being applied after the full effect of the first, or within seven to ten days.

For best results, steps should be taken to prevent drought or water stress prior to or at the time of defoliation. Water stress will usually prevent satisfactory chemical defoliation by causing dried leaves to remain attached to the plant. In defoliation of any lodged cotton a certain amount of trash results in mechanical picking, but it was found in the ' De-Fol-Ate ' tests that leaf removal frequently allowed the plants to stand up. This reduced boll rot and eased mechanical picking of such plants.

The most important factor in defoliation is timing. Plants should be mature, a condition which can be judged by the experienced grower. Bolls which the grower plans to pick for lint should be fully matured, but not necessarily open prior to defoliation. Defoliation with this formulation usually takes from five to eight days in warm weather, but may take 12 days or longer in cool weather. If very few bolls are open at the time of application, a few more days may be needed after leaf fall to allow them to open fully.

There are many variables affecting defoliation. Temperature, humidity and varying states of plant maturity are a few of the more obvious ones, and beyond these are many factors, not too well under-



A field of rank down cotton (*left*) looked like this (*right*) seven days after application of ' De-Fol-Ate ' from an aeroplane

stood and widely varying, of plant chemistry. The problem was to develop a chemical versatile enough to cover a broader scope of these variables and 'De-Fol-Ate' appears to be a step in this direction.

Pakistan Developments

The Sind Government have planned to reclaim over 20,000 acres of land by the setting up of pumping stations. Water will be pumped from the River Indus into a 12½-mile long channel to irrigate a vast expanse of fertile land. The project will be completed by the end of 1954 at a cost of about 500,000 rupees.

The Food and Agriculture Organisation in 1953 spent in Pakistan more than 423,000 dollars to provide experts on irrigation, refrigeration and the improvement of poultry and livestock. During the same period Pakistan has spent 1.7 million dollars on implementing development projects in these fields.

Royal Show News

H.M. the Queen will visit the Royal Show at Windsor on two days and proposes to give three cups for award at the 1954 show. One will be awarded for the best beef bull and a second for the best dairy cow. The third is to be offered in one of the Young Farmers' Club livestock competitions.

The 1957 Royal Show will be held at Norwich. The Council of the Royal Agricultural Society of England, at its meeting on December 2, agreed to accept an invitation from the Royal Norfolk Agricultural Association to use its new site at Costessey, four miles from Norwich. This will be the Royal Show's fourth visit to Norwich, where it was held previously in 1849, 1886 and 1911.

Technical News

Included in the February issue of **Fibres** are the following articles: 'Some Applications of Radioactive Isotopes in Wool Research', by Dr. A. Robson; 'Mothproofing Agents and their Applications'; and 'Asbestos—the Mineral Fibre.'

The February issue of **Paint Manufacture** includes 'Some Observations on the Manufacture and Properties of Dehydrated Castor Oil,' by P. Slansky; 'History of Paints and Varnishes in Great Britain—3', by F. Armitage; and 'Immersed Paint Coatings on Metals'.

Manufacturing Chemist for February includes the articles: 'Phenylethyl Alcohol' by F. Schmitt; and 'The Pyridine Drugs', by S. Collett.

Plastics in Plant Propagation

DR. A. VAN DER MEULEN

Citrus and Subtropical Horticultural Research Station, Nelspruit

PLASTICS are organic materials, mostly synthetically made. They can be moulded easily and possess a certain degree of elasticity. A polyvinyl chloride plastic, made into very thin sheets, has now found its way into plant-nursery practice. It has proved to be an economical and very useful material, being durable and strong, suitable for tying or wrapping purposes in budding, certain ways of grafting, and air-layering. Under many circumstances, it has important advantages over raffia, rubber strips, waxed cloth or hessian cloth, which are at present generally used for these purposes. To best appreciate the specific value of this plastic material in plant propagation, the essential points in budding, grafting and air-layering should first be considered.

Budding

Budding is a way of vegetative plant propagation. A small portion of the mother plant, the scion—in this case a bark shield containing one bud—is placed under the bark of another plant, the stock or root-stock. The two parts will unite and form one plant. After the fusion of the two components the remaining undesired top portion of the stock is cut away. The root-stock thus mainly makes the subterranean part of the plant and the scion the portion above the ground.

The union between stock and scion can only take place by fusion of their cambium layers. This cambium is in general the one-cell thick layer between bark and wood. The inserted scion is completely dependent on its reserves for water and food supply as long as the fusion of the two layers has not been initiated. In budding citrus, this fusion may start within 48 hours after budding, but in many other plants it may take much longer. The condition of the stock and scion, the technique of budding, as well as the climatic conditions, are important in this respect.

The first few days after budding are critical because any drying out of the bud might be fatal for a normal 'take' or growth fusion. It is therefore essential to try and keep the evaporation from the scion during this early stage at a minimum. This is done by placing the bud on the side of the stock where direct sunshine will not reach it. Covering the newly inserted bud with fresh leaves may also help. The raffia, normally used as tying material, also reduces evaporation to a certain extent. It is well-known that budding done on hot sunny days, with a dry wind blowing, is more liable to fail than budding done while it is cloudy without wind. In many parts of the Union the relative air humidity is liable to drop very low during daytime. This will certainly promote evaporation and may be responsible for the low take in budding of certain plants, *e.g.*, the mango, in comparison with the far better take in other parts of the world where the humidity is constantly considerably higher.

The special grade of polyvinyl plastic now being used as a tying material for budding is such that it does not allow water-vapour to pass through it, while at the same time it is permeable to air and gases. In this way, it protects the covered shield against drying out, while not hindering the shields from breathing and in general the exchange of products of its metabolic activity with the surrounding air. Budded mangos, which had their shields and buds completely tied and covered with this plastic, were kept wrapped for over ten weeks. After unwrapping, the scions were still in perfect condition and the buds grew out after some time. In some instances the bud has already started to push while still covered. Tying a bud, however, with a water-tight plastic which is not air-pervious will be fatal for the bud.

The plastic for this purpose is best used in strips about half an inch wide. It has the added advantages of being transparent, strong, very elastic and durable. If applied in the right way by stretching it almost fully during the tying process, it presses stock and scion well together, thus favouring a quick fusion. The troublesome unwrapping and re-tying of certain types of buds after some time, as for instance in avocado budding, can be eliminated. There is no danger of the wrapping strangling the stock. If budding must be done on rather dry stocks, the bark and wood will not separate easily. Results on such stocks are usually poor. If, however, the wrapping is done with the polyvinyl plastic the take can be as good as with stocks at the correct stage for budding. Any rain soon after the budding may damage an inserted bud if it is not covered watertightly. Buds wrapped in this material are protected against rain.

The main advantages of this plastic over the other tying materials used in budding can be summed up as follows:—

(1) It protects the bud against drying out.

(2) It allows the bud to ' breathe ' while still tied.

(3) It is elastic and durable and therefore presses scion and stock strongly and evenly together.

(4) It still retains a certain degree of elasticity when applied and will not strangle the stock.

(5) It protects the newly inserted scion against rain.

Grafting

In principle, grafting is the same as budding, with this difference, however, that the scion is mostly longer and that it contains more than one bud. The plastic strips can be useful in certain grafting techniques when the stock and scion are absolutely of the same diameter, *e.g.* in 'whip' and in ' whip-and-tongue ' grafting. In such cases the wound can be completely and tightly tied. The plastic can maintain its elasticity and the closing of the wound with seal or wax can be omitted.

Air-layering

A third field where plastics can be used with advantage is in the air-layering process. This is another way of propagating plants vegetatively, in which a portion of a branch of a mother plant is covered with a ball of moist moss or any other suitable rooting medium. Many plants will readily form roots in such medium, if certain precautions are taken. The rooted branch can then be separated from the mother as an individual plant. Although it is an elaborate and expensive method it is still a common practice because certain plants, *e.g.* the litchi and some ornamentals, cannot readily be propagated vegetatively in any other way.

The normal procedure in air-layering is that the ball of damp rooting material, packed in hessian cloth, is wetted at regular intervals. It can also be kept damp automatically by means of a cotton string leading from a tin of water placed at a higher level. Both methods require much labour and care.

The ball of moist rooting material can, however, also be completely enclosed in a sheet of the polyvinyl plastic. In this way there will be practically no evaporation and no water is taken up by the newly formed roots, because the mother plant still meets the water requirements of the branch. The high amount of oxygen needed for the developing roots can, on the other hand, easily enter through the plastic, while other gasses generated during the growth of the roots can pass out freely. Ideal rooting conditions are found inside the ball of rooting material wrapped in such a way. The growing roots can be seen through the transparent plastic as soon as they start growing outside the rooting material. Once the air-layer has been made in this way, no labour and little supervision is required until it can be separated from the mother plant. Results obtained with this plastic wrapper are at least as good as those with a hessian wrapper. If, however, an air-tight plastic is used for this purpose, rooting may start, but rotting will certainly follow. Credit must be given to the late Col. W. Groves, of Florida, U.S.A., for having been the first to develop this technique in the commercial propagation of litchis.

In the nursery, the slightly higher price of this plastic is easily compensated for by better results, better plants and the labour saved. It must be remembered, however, that it is an aid only and in no way a magic one. No success can be anticipated if the budding, grafting or air-layering itself is not done with the normal care and skill, using the correct propagating material.

(From *Farming in South Africa*)

Angola Agricultural Prospects

A vast new food-producing region, potentially one of the richest in Africa, is reported to be in process of opening up by the Portuguese on the highveld of Angola. The Assistant Director of Soil Conservation, Pretoria, said the possibilities there are unlimited. He recently undertook a 3,000 mile tour of the country with other South African experts. Very large areas have a rainfall of 40 to 60 in. a year, with deep, relatively fertile, granite soils and a level or undulating topography ideal for farming as well as forestry. There is no erosion because there has been practically no development. In the past four years, however, the Portuguese have begun to develop it on settlement lines, with settlements for natives and for Portuguese farmers. It could become a very large food-producing area.

WORLD CROPS

IN OUR NEXT ISSUE there will be an article on the **Cashew Nut** by A. E. Haarer, while R. J. Courshee will be discussing the **Characteristics of Spraying Nozzles. Irrigation in North Africa** will be discussed by D. Anley, and there will be an article on **Fire in Crops.** There will also be additional articles besides the regular features.

Tea in Portuguese East Africa

Not an inconsiderable quantity of tea from Portuguese East Africa is consigned to the London auctions and 12 factories are now in operation in Portuguese East Africa and two more are being put up in Socone (Montualasse Estate) and Tacuane (Cha Madal). Three new factories were completed in the Gurue district in 1952 at Metilile, Montebranco and Mualacala, all in excellent buildings and well equipped with up-to-date machinery. The old factory at Mualacala has been closed down. Eight of these factories are in the Gurue, one in Tacuane and three in Milange. A scheme is now under Governmental consideration for a co-operative factory to be put up in the Gurue where small planters can have their leaf manufactured instead of selling it to the larger estates.

Planting of new areas has been very active in Tacuane and Socone and some new areas have also been planted out in the Gurue and Milange. Cha Montebranco (Gurue) planted over 400 acres in 1952. The total area under tea at the beginning of 1952 was approximately 20,128 acres and production for 1951 was 7,054,720 lb. Except for one or two bad cases of armillaria and red spider, practically no serious incidence of pests and diseases has been observed. Production per acre is still very low, which is probably due to poor quality of jat and, in many cases, to deficient agricultural methods and lack of shading and fertilising.

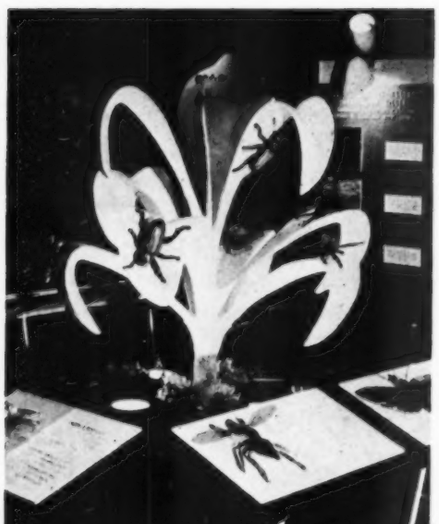
The tea industry in Portuguese East Africa is very young. It is not surprising, therefore, that most teas turned out before the end of the 1951-52 season were of the low medium and common types for which a strong demand was noticeable during and after the war years. This caused a very heavy blow to the industry in 1952, when estates suffered severe losses and were possibly more affected thereby than in other parts of the world where similar teas had been produced.

Financial shortcomings have caused many estates to curtail their labour forces. This will result in the 1952-53 crop falling short of the previous one, but a fair recovery, without diminishment of quality, should be expected in 1953-54.

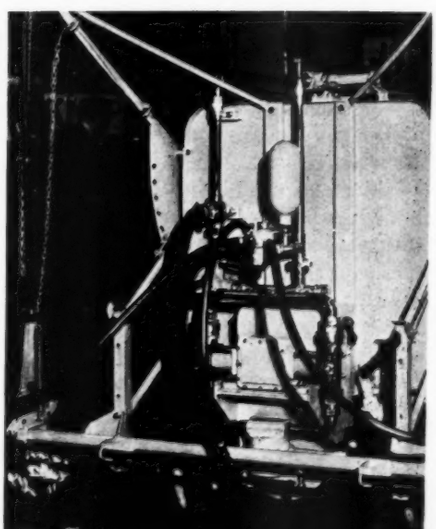
The potentiality for development of the tea industry in Portuguese East Africa is said to be enormous. Cost of production can still be kept at a low level, law and order are prevalent throughout the colony and the tea-belt spreads over an area of more than half a million acres of rich and chemically suitable land, under a very adequate climate and rainfall.

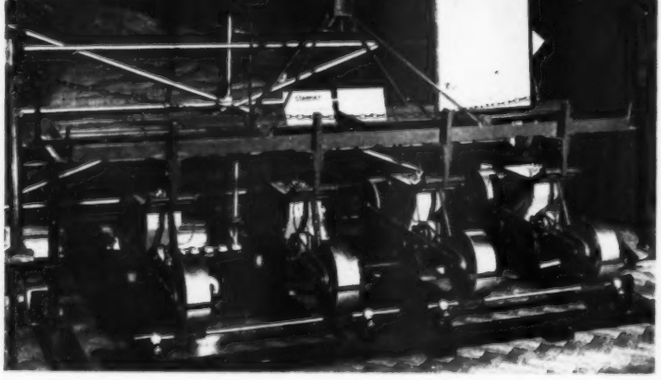
(*The Tea and Rubber Mail*)

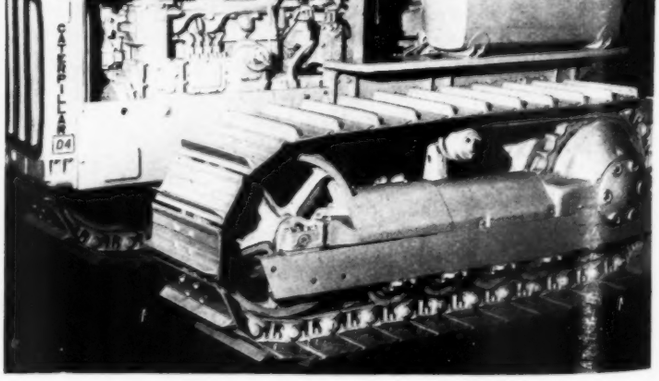
THE SMITHFIELD SHOW



We print on this page some stand photographs taken at the Show by our photographer. (*Above*) **A general view of the main exhibition hall.** (*Left*) **Part of the display of the stand of Burt, Boulton and Haywood Ltd.** (*Right*) **This 'Fieldmaster' sprayer was a feature of the Pest Control Ltd. stand.** (*Below, left*) **This machine on the Stanhay stand attracted attention.** (*Below, right*) **The D4 Caterpillar tractor, which was exhibited on the stand of the Caterpillar dealers**







RESEARCH DEVELOPMENTS

Vanadium an Essential Nutrient?

ROTHAMSTED research[1] has shown that low concentrations of vanadium can partially offset iron deficiency symptoms, especially when the iron deficiency is caused by excess manganese. Later work at the same centre[2] indicated that vanadium was toxic even at as low a concentration as 2.5 p.p.m., but that the effects were lessened in the presence of ample iron. These results were obtained in culture growth experiments with soya bean and flax, and not dissimilar results were subsequently obtained with peas. However, the British approach to vanadium as an influential factor in plant nutrition would seem to have been one of partial substitution for other nutrients or of complex interrelationship with proven nutrients. Now, and without the usual preliminary gropings towards discovery, D. I. Arnon and G. Wessel, of the University of California, have put forward striking evidence that vanadium is an essential micro-nutrient for green plants.[3]

Occurrence of vanadium

Although vanadium is one of the lesser-known elements, it is fairly widely distributed. It makes up 0.03% of the earth's crust, according to one authoritative mineral estimate, and is actually more abundant than such well-known metallic elements as copper, lead, zinc and tin. That it has biological functions may well have been suspected for a good many years, for vanadium is known to accumulate in natural deposits; however, the fact that an element may be assimilated by plants has never been looked upon as proof that it exercises essential functions of nutrition. A French war-time paper[4] reported that analyses of 62 different plant species revealed in every case the presence of vanadium. It is perhaps not wholly irrrelevant to the theme of vanadium as a plant nutrient to note that its chemistry is exceedingly 'versatile'; to quote from a post-war treatise on the rarer or lesser-known elements, 'it rivals carbon in the large number and wide variety of complex compounds that it may form.'[5] Although a metal, vanadium is a member of the same family of elements as nitrogen, phosphorus and arsenic; its atomic kinship with nitrogen and phosphorus may be distant, but some of the established micro-nutrient elements (copper, zinc and molybdenum) are also distant relations of major nutrient elements.

The role of vanadium

The new evidence about vanadium from California has not emerged from experiments directly aimed at this element's biological functions. One of the green algae species, *Scenedesmus obliquus*, was being grown on nutrient solutions and the effects of variations in iron supply were being studied. A standard solution providing the five established trace nutrients (boron, manganese, copper, zinc and molybdenum) was given. Very marked increases in algae growth resulted from increases in the iron concentration and it was conjectured that impurities in the iron source rather than iron itself might be responsible. Since the known micro-nutrients were already supplied, the most likely elements for consideration were cobalt, nickel and vanadium. New experiments using a very pure source of iron (ferric chloride) with and without the addition of a solution containing cobalt, nickel and vanadium were then carried out. The marked growth effects previously associated with rising concentrations of iron were clearly shown to be due to cobalt, nickel and vanadium, to one or to all three of these elements. In the next series of experiments solutions of these elements' salts were separately added and the growth effects were isolated as being attributable to vanadium. Moreover, the withholding of the vanadium solution caused the development of deficiency symptoms and the supply corrected the deficiency. There have, since the establishment of molybdenum as an essential element, been one or two suggestions and attempts to show that vanadium can substitute for molybdenum, but it has been pointed out by Arnon and Wessel that these effects of vanadium have been observed in the presence of an ample molybdenum supply.

To show that an element is essential for the growth of green algae or, more accurately, of one algal species is not, of course, to show that it is also essential in the nutrition of higher plants. Nevertheless, the proof of essentiality for lower green plants has generally been followed by the more general proof; photosynthesis is the chemical *modus operandi* for both simple and complex green plants.

Against the case for vanadium as so far presented, the observation that this element even at as low a concentration as 0.1 p.p.m. 'has no influence upon growth' in culture work with flax and soya bean cannot be ignored.[6] The lowness of concentration here is important, for it might otherwise be considered that beneficial effects had been obscured by the toxic effects of too high a concentration. Opposed to this negative observation, however, German pot experiments went so far as to indicate that the vanadium content of basic slag (as calcium vanadate) is an important factor in this fertiliser's effectiveness.[7]

The role of vanadium now seems widely and actively open for discussion and for further experimental study. There are many elements of dubious nutritional importance which have received much more attention, but vanadium suddenly seems to have become the most probable candidate for the sixth place in the short list of trace elements.

D. P. HOPKINS

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Royal Society of Arts Competition

The Royal Society of Arts will reach its bicentenary in March 1954 and with this in mind its council is arranging, in addition to various customary forms of celebration which will commemorate the Society's past achievements, a competition which will focus attention upon the future. The Society accordingly offers prizes totalling £500, the largest being £250, for conceptions of life on this planet in the year 2000, and forecasts (in visual or written form) are invited of the future developments which may be looked for in some particular aspect of life related to arts, manufactures and commerce, the field of the Society as defined in its full and original title. The competition is open to (*a*) persons of British nationality, and (*b*) Fellows and Associates of the Society of whatever nationality.

Full terms and conditions relating to the competition, together with registration forms, may be obtained from the Secretary, Royal Society of Arts, John Adam Street, London, W.C.2. Registration forms must be completed and returned together with an entry fee of 1s. by February 15, 1954 and the actual competitive material submitted by June 30, 1954.

NEW BOOKS

Rice

By D. H. Grist. Pp. xix + 331. Longmans, Green and Co. 1953. 35s.

The author of this very readable new volume, in a series edited by Sir Harold Tempany, gives a fascinating comparison of methods of cultivation in different countries. The range of the book is wide, covering the botany and agriculture of the crop, pests and diseases, storage, milling, economics and the nutritional value of rice as a food.

The importance of water control and drainage are rightly stressed; too often mere abundance of water is thought sufficient.

The chapter dealing with the origin of rice is separated from those dealing with the characteristics of the plant, its varieties and their classification, whilst only in the appendix is there a brief mention of the two major types of cultivated rice, Japonica and Indica. Cultivated rice is referred to in chapters 1 and 4 as *Oryza sativa*, although this name is not used in chapter 5, where it is remarked that ' The cultivated varieties of paddy are derived from hybrids of *Oryza fatua*, *O. minuta* and other species.' The species named *Oryza glutinosa* is introduced in chapter 5. Here (p. 64) reference is made to the two main classes of ' hard ' and ' soft ' varieties, but it appears as if the term ' soft ' is sometimes used for glutinous rices and sometimes for forms intermediate between hard and glutinous ones. Interesting though these chapters are, readers who are not rice breeders may be puzzled as to what is the link-up between the two major types (Japonica and Indica), the wild parents, the hard and soft rices, and the groups with different chromosome numbers.

For many rice areas there is now abundant evidence of the usefulness of fertilisers, and one is a little surprised to read that, ' while some improvement may be expected by this means, it is probable that undue emphasis has been given in some quarters to the need for fertilisers.' It is stated that the requirement of first importance in many areas is humus with or without the addition of fertilisers, and that organic matter is usually available in overwhelming quantity in many paddy-growing regions, the only requirement being labour to collect and transport it to the fields. This is not true of the ' rice bowls ' of India and China, and Yates, Finney and Panse (' The Use of Fertilisers on Food Grains,' I.C.A.R. Research Series No. 1) write of India that ' For much of the land, therefore, the choice is not between inorganic and organic fertilisers, but between inorganic and no fertiliser. The only way of increasing the humus content of the soil is then to apply sufficient inorganic fertilisers, so producing larger crops and larger inorganic residues.' However, Grist finally expresses the view that crop yields can be raised to a higher level ' at least in some regions—probably in all—by the extended use of natural manures and artificial fertilisers,' which is perhaps the conclusion that matters most.

Errors in the book are few. A reference to three-factor inheritance of internodal colour (p. 44) is evidently concerned with complementary genes, giving ratios of 3: 1, 9: 7 or 27: 37, and not as printed. Leaf-hoppers do not ' cause ' dwarf disease, though they transmit the causal virus. The reference to ' a cultivated genus of *Oryza* ' (p. 41) should be to ' a cultivated species.' These, however, are minor points. The book has been attractively produced and is profusely illustrated with splendid photographs (some of them in colour) and a number of line drawings. The long list of well-chosen references covers a wide range of subjects. The book as a whole can be commended to all interested in the rice crop and it is not too much to say that no worker in this field should be without a copy on his bookshelf.

G. W. P.

Manuel de la canne a sucre

By P. de Sornay and A. de Sornay. 2nd edition. Pp. 279. Mauritius, The General Printing and Stationery Co. Ltd. 1953.

This is the second and enlarged edition of a work published first in 1936; when it first appeared it was, so far as the reviewer is aware, the only work devoted exclusively to the agriculture of the sugar cane. The senior author is well known both in Mauritius and also many other countries for his work in connection with the sugar industry, while the junior author who collaborated in the second edition is geneticist in the sugar research station in Mauritius.

The book, in the course of some 19 chapters, traverses the operations involved in the husbandry of the cane, as well as certain other apposite matters such as the botany of the sugar cane, sugar cane varieties and the raising of new forms, as well as the principal insect enemies and fungoid, bacterial and other diseases which attack the sugar cane, all of which are clearly and succinctly dealt with.

The book was written primarily from the standpoint of the sugar industry as developed in Mauritius, but much information is included concerning the agriculture of the sugar cane in other lands, while the characteristics of the industry in the main sugar producing regions of the world are discussed in a separate chapter.

The book is illustrated with a number of plates and line drawings. It was written primarily for the use of students in agricultural schools and colleges; as it is in the French language its main appeal lies in regions where the French language is spoken, and there it should meet with wide appreciation.

H. T.

Cocoa

By Eileen M. Chatt. Pp. xiv + 302. New York and London Interscience Publishers. 1953. $8.50.

This book forms one of a series of monographs on the chemistry, physiology and technology of foods and food products produced under the general editorship of Mr. Z. I. Kertesz, other volumes in the series having been concerned with bananas, apples and seed corn. This particular volume deals with the cultivation, processing and analysis of cocoa and is from the pen of Miss Eileen M. Chatt, a member of the staff of the British Food Manufacturing Industries Research Association.

The book is ambitious inasmuch as in the space of 302 pages the author attempts to cover all aspects of cocoa production from the planting of the tree to the manufacture of the finished product, including a historical survey, a description and discussion of the botany of the tree, its cultivation, the pests and diseases which attack it, the chemical changes which occur in the maturing fruit, the manufacture of chocolate liquor, the manufacture of cocoa powder, cocoa butter and chocolate, the nutritional value of cocoa products, methods of analysis, and a survey of the various cocoa producing countries and of the present position of, and outlook for, the industry.

Let us say at once that the author has acquitted herself of her task with conspicuous ability and success. The reviewer knows of no book dealing with a tropical crop which covers so much ground in so short a space with such completeness.

On the cultivation side, the various aspects are discussed with admirable conciseness, while the documentation is very full and complete. One can only regret that here, presumably on account of the time factor, it was not found possible to include any account of the outstanding recent work of Evans at the Imperial College of Tropical Agriculture on propaga-

tion methods and minor element deficiencies.

The numerous maladies to which the cocoa tree is subject are adequately dealt with, although in discussing swollen shoot insufficient stress is laid on the very numerous strains of the virus that have been isolated, while although mention is made of the systemic insecticide treatment with Hannane, it is not indicated that this insecticide has been found to have an objectionable influence on the taste and flavour of the ultimate product.

In the review of the possibilities of developing cocoa cultivation in other parts of the world in Chapter XII, it is unfortunate that no mention could be made of the extensive tours of Urquhart on behalf of the South Pacific commission and his conclusions regarding the possibilities in that part of the world. It is also noteworthy that in the general review of the world situation in the latter part of the same chapter no mention is made of Wickiser's notable assessment of the position in his book 'Coffee, Tea and Cocoa.'

These are, however, small matters and the author and the publishers are to be congratulated on a valuable contribution to the literature of a subject which is yearly growing in importance.

H. T.

Manual of Cane-Growing

By Norman J. King, R. W. Mungomery and C. G. Hughes. Pp. 349. Angus and Robertson. 1953. 63s.

The paucity of works dealing with the agriculture of the sugar cane was until recently a striking feature. Recently, however, this defect has been remedied by the appearance of no less than three books dealing with the practice of cane growing, of which the first two are A. C. Barnes's *Agriculture of the Sugar Cane* and P. de Sornay's *Manuel de la canne a sucre*.

This book is the third. In the current issue of WORLD CROPS there appears a short general article on the Queensland sugar industry, but anyone who desires a more detailed and complete account could not do better than refer to this work, which deals exhaustively with practically all aspects of the cultivation of sugar cane in Queensland and is packed with information. Where all is so excellent it is difficult to pick out individual chapters for praise, but to the reviewer those dealing with the soil in relation to cane culture, green manuring and organic matter, as well as those on irrigation, weed control and the harvesting of the cane appear to be specially excellent. The chapter on cane diseases written by Dr. C. G. Hughes and that on pests written by R. W. Mungomery are also noteworthy. The book itself is well printed and is illustrated by a large number of half-tone engravings and diagrams in the text as well as by a number of coloured plates. As a whole, it is worthy to take a high place among the literature of the sugar cane. A point of criticism, however, is that the high price of the book, £3 3s., may place it above the reach of potential readers not only in Australia, but in other countries where the sugar cane is grown.

H. T.

Physiology of Seeds

An introduction to the experimental study of seed and germination problems by the late Wm. Crocker, Ph.D., and Lela V. Barton, Ph.D. Pp. xv + 267. Chronica Botanica Co. 1953.

Much of the original research which forms the basis of the techniques used in modern seed technology has been carried out either in attempts to solve fundamental problems of plant physiology, in which seeds have been used as experimental material, or in investigations of seed samples in order to assess their quality. The literature as a whole is widely dispersed, and many classical papers are virtually unobtainable. International interest in the subject, however, was recently demonstrated at the 10th Congress of the International Seed Testing Association, when delegates from 23 member countries unanimously adopted revised international rules for seed testing. The publication of the present volume therefore comes at a most opportune moment.

The authors, who have carried out distinguished researches in this field over many years at the Boyce Thompson Institute, do not claim that theirs is a complete account of the subject but rather a survey of the present state of our knowledge of seeds and germination. Their book will be judged by the extent to which it presents a balanced picture of the important developments which have taken place in seed technology.

The book is divided into 17 chapters each with a bibliography. Those dealing with the factors affecting germination, dormancy and the metabolic and energy changes in seed development and germination present information which has not been readily available before and give a satisfactory summary of the present position. The chapters on vernalisation, embryo culture and seed transmission of disease give concise accounts of topics which are increasingly attracting the attention of those concerned with the effect of the seed on subsequent plant development. The two chapters which have been devoted to cataloguing the chemical compounds found in seeds are difficult to justify without greater reference to the abundant literature which is now available from industrial sources. On the other hand, the chapters on the anatomy of seeds, seed production, the water relations of seeds, seed respiration, and the storage and life span of seeds could well have been expanded if space had been available. The one major omission is the absence of any reference to the increasing use which is being made of anatomical and physiological characters for purposes of seed identification. The bibliography, in addition to quoting outstanding American work, also gives adequate references to recent work in many different countries as well as to the classical literature.

The book will be of use primarily to those workers who are concerned with problems arising from the introduction of new agricultural techniques for producing, treating and processing seeds. It will also be of interest to the research worker who is applying to the unsolved problems in seed physiology the new techniques which are now being developed.

P. S. W.

Portuguese Monograph on Rice

O Arroz—Estudo Botânico (*Rice—A Botanical Study*). By Prof. João de Carvalho e Vasconcellos. Pp. 302. Portuguese Rice Board, Lisbon. 1953.

This publication, sponsored by the Portuguese Board of Trade and actively supported by the Portuguese Rice Board, is the amplification of a botanical treatise, first published in 1939 and reprinted in 1944, on all the varieties of rice cultivated in Portugal. It now represents a comprehensive monograph on all that is worth knowing about rice cultivation in that country.

Identification of the many different cultivated varieties of rice is based on organographic methods, dealing separately with seed, root, stem, leaf, etc. The author then deals with certain aspects of plant physiology, including nutrition, metabolism, growth and development, reproduction and maturity. Another chapter is devoted to immunity and resistance to diseases. There follows a brief chapter on the origin of rice and the systematics of Oryza Sativa. The second half of the book is taken up by an amazingly comprehensive and well-illustrated description of each of the many sub-species of rice cultivated in the country. The value of this book is enhanced by an ample and up-to-date bibliography on rice cultivation and related subjects.

FARM MACHINERY

Diluter Instrument

A new auto-accurate instrument known as the ' Bio-meter ' is being produced by Finch and Knight Ltd. and distributed by Pan Britannica Industries Ltd. The instrument has been developed after some four and a half years' work on the problem of injecting concentrates into the water-flow of nursery hose and irrigation systems.

The instrument, which is available in a number of sizes, is operated by the water-flow and will dilute over a range from 1 : 45 (sterilising range) to 1 : 1,000 (fluid feeding and insecticide range). It can be set to any intermediate reading by a pointer on a dial, and, once set, will retain its accuracy of dilution, independent of changes in the water-flow.

Reflector Closure

A new Mazda 'Perspex' closure for use with Mazda industrial fluorescent trough-type reflectors was exhibited for the first time in London recently. The closure is pressed from a single sheet of 'Perspex' and attached directly to the reflector by aluminium and rubber straps. Its use is primarily to prevent the possibility of glass from a broken lamp falling into a product handled beneath it and, secondly, to keep the product and dust out of the fitting.

Trench Excavator

The new ' Dinkum Digger ' trench excavator, made by Whitlock Bros. Ltd., was shown recently in London. Operation is entirely by hydraulic control, the power being derived from a small pump mounted on the tractor. The machine itself is mounted from the tractor rear axle by pivot pins, which enable the hydraulic lift of the tractor to be used for raising it into the transport position. One hydraulic two-way ram is used for digging, another for raising, and a third for slewing in either direction. A fourth ram, which is available for attachment to the bucket, not only increases output, but also enables the machine to cut vertical ends to the trench, to load direct into lorries and to be used as a forward shovel. These rams are controlled by two-way valves operated from a seated position on the tractor by the driver, who, being over the trench, has a full view of all operations.

It is said that the tractor engine cannot be stalled, for a specially designed safety relief valve enables full power to be maintained even when digging in the most difficult ground. This also prevents damage to the hydraulic system of the machine. The valves are designed to allow the engine and pump to run off-load when no power is required.

Roller Tractor Dumper

Now in production is the Nash ' 10,' a four-wheel version of the three-wheel Nash roller tractor dumper recently introduced to the market. The Nash roller-axle at the rear is again featured in the new model. This patented transmission device acts as a heavy flywheel, imparting a drawbar pull said to be greater than that of any other tractor of comparable size, assuring a constant speed over rough ground and protecting the engine from sudden strains.

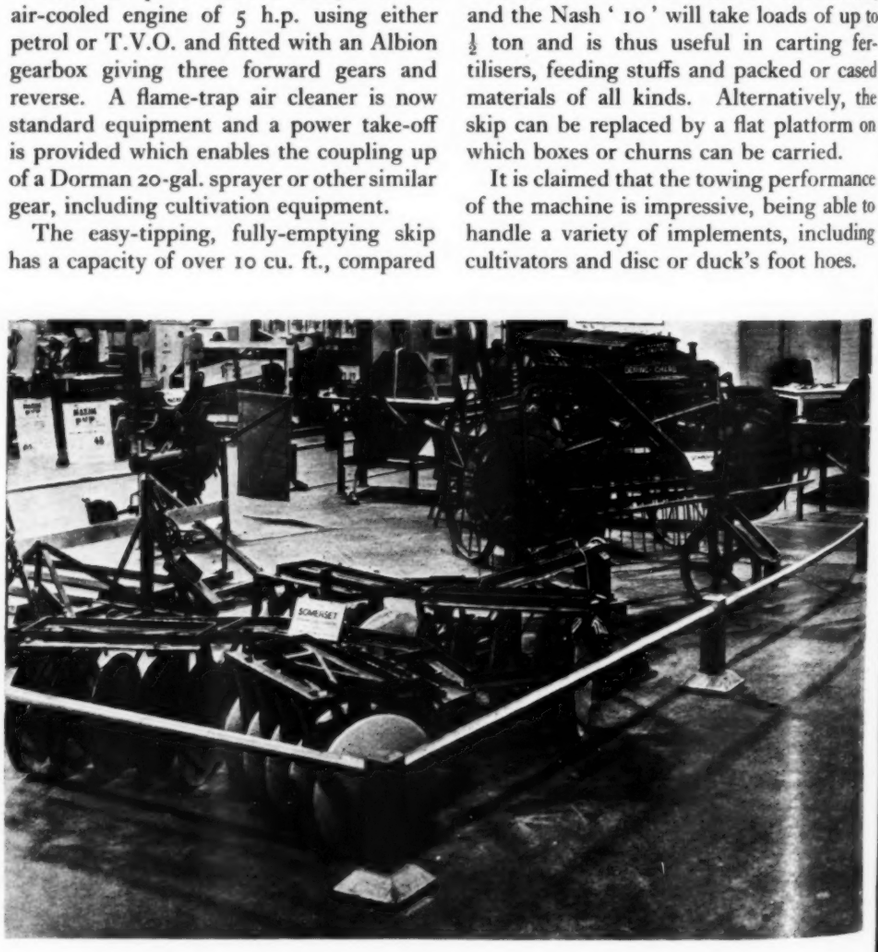
In the few minutes which it takes to remove the rear wheels the Nash can be converted to a useful power roller; in addition, outrigger rollers—available as an extra—can be fitted in place of the wheels, giving additional grip by driving on three rollers.

The same power unit is used, a B.S.A. air-cooled engine of 5 h.p. using either petrol or T.V.O. and fitted with an Albion gearbox giving three forward gears and reverse. A flame-trap air cleaner is now standard equipment and a power take-off is provided which enables the coupling up of a Dorman 20-gal. sprayer or other similar gear, including cultivation equipment.

The easy-tipping, fully-emptying skip has a capacity of over 10 cu. ft., compared with the 8 cu. ft. of the three-wheel model, and the Nash ' 10 ' will take loads of up to ½ ton and is thus useful in carting fertilisers, feeding stuffs and packed or cased materials of all kinds. Alternatively, the skip can be replaced by a flat platform on which boxes or churns can be carried.

It is claimed that the towing performance of the machine is impressive, being able to handle a variety of implements, including cultivators and disc or duck's foot hoes.

The 'Dinkum Digger' as seen from the bottom of an 8 ft. deep trench



The stand of Denings of Chard Ltd. at the Smithfield Show

It is fitted with car-type Burman box steering, four-wheel brakes and has centre pivoting axles which provide for a 9-in. independent lift on either front wheel. The machine is said to be highly manouvrable, simple and comfortable to drive and small enough to pass through gates and under low hanging trees.

Cattle Crush

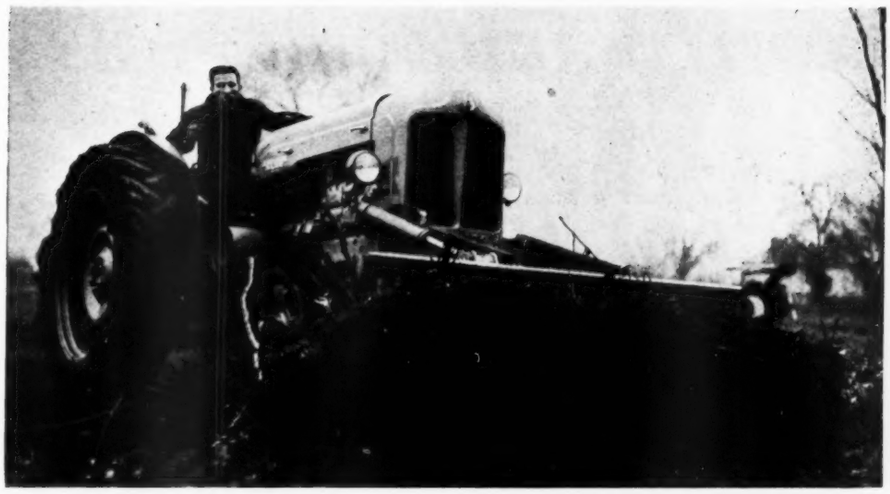
A new tubular steel cattle crush designed for quick and efficient handling of cattle for ear marking, warble dressing, tuberculin testing, inoculation, grooming and general veterinary service has been introduced by Geo. W. King Ltd. It is said to be readily adaptable for use in conjunction with existing buildings and yard layouts and, by reason of the construction employed, can be modified to suit most requirements.

Three units form the complete crush, any of which can be purchased separately. They are: (*a*) Fore unit with yoke gate, pair telescopic rails with check pins, and tail bar with special fittings to provide vertical and horizontal adjustment. (*b*) Back unit, also with tail bar and special fittings for adjustment. (*c*) Pair guide barriers for attachment to fore unit or back unit, provided with hinge fittings so that the size and shape of entry area can be varied.

Hydraulic 'Muledozer'

The hydraulic 'Muledozer,' which is now being produced by Leeford (London) Ltd., is a hydraulically-operated bulldozing blade fitted to the new Fordson Major. A special sub-frame carrying the blade is carefully stressed to safeguard the tractor against overload. Use is made of the hydraulic equipment incorporated in the Fordson tractor, to which the hydraulics of the 'Muledozer' are coupled. The patented and specially designed hydraulic circuit incorporates a three-way selector valve very conveniently placed at the driver's right. There are three operating positions: (1) Positive down thrust, (2) lift and (3) 'hold.' Whenever the driver takes his hand off the operating lever the lever automatically returns to 'hold' position.

The hydraulic 'Muledozer' has been specially designed for work with the New Fordson Major and the hydraulic equipment amply dimensioned for the purpose. The double-acting jack has $2\frac{3}{8}$-in. bore and 13-in. stroke and lifts and lowers the blade, which is 6 ft. wide. The total movement of the blade is 21 in., giving a 15-in. clearance when lifted and 6-in. penetration. The blade is reinforced for heavy work. For special jobs the V blade, with a 45° delivery angle either side, is available and interchangeable with the ordinary blade.

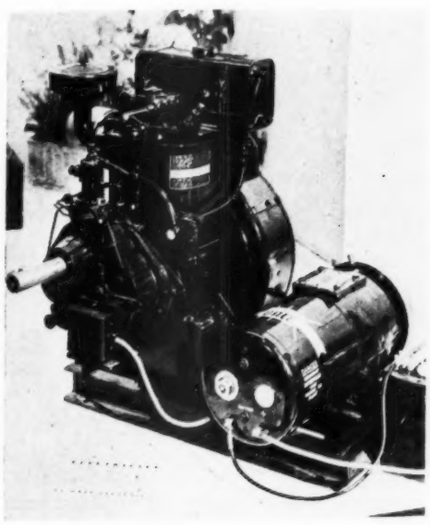


The hydraulic 'Muledozer,' fitted to a Fordson Major, in action

The back of the tractor is completely free for towing, haulage or, alternatively, for an earth scoop, which can also be operated by the hydraulic power lift of the Fordson Major tractor. There is also a 'stinger blade' available for the cutting of the roots prior to removing shrubs, hedges and small trees.

Generating Set

One of the world's smallest diesel generating sets made its first appearance at the recent Dairy Show held in London. There is a range of these units available, namely, fully-automatic remote control and hand starting types. The units can be supplied suitable for any standard a.c. voltage. They are manufactured by Dale Electric (Yorkshire) Ltd., Filey, whose exports are handled by Dale Electric (Export) Ltd. of the same address.



A Dale generating set, of which a range is now available

This new plant incorporates a Petter 'Pazi' air-cooled, single-cylinder, direct-injection oil engine of 3-in. bore and stroke, developing $2\frac{1}{2}$ b.h.p. at 1,500 r.p.m. The generator is driven by multi-vee belts from the engine and is of the drip-proof, fan-ventilated type, fitted with heavy-duty ball bearings. It is self-excited and self-regulated, with starting and charging windings, and is 'tropically' insulated.

Engine and generator are mounted on a baseplate constructed from heavy rolled-steel channel, with side rails built in and complete with belt adjusters and holding-down bolts. A switchbox is provided and is fitted with ammeter, circuit fuse and push buttons. Contactors are fitted inside the switchbox for semi-automatic operation, also a connection block for the outgoing cables to load. Engine starting is by means of a 12-v. battery provided for this purpose.

This generating plant has been designed to meet the long-felt want for a very small diesel-driven generating set, reasonable in first cost and cheap to run and maintain.

Rust Preventive

Many farmers may find 'Meprol' preventive solution a great help in protecting their valuable harvesters and implements from rust. 'Meprol' is a thin, clear, colourless, non-inflammable dipping solution to prevent rust, oxidation or dulling. It is said to be effective when brushed or wiped, or even sprayed on, for protecting farm implements, etc., during the winter. They should be occasionally inspected and possibly a further application of 'Meprol' by brushing on, applied as and when required. Metal Processes Ltd. make about 18 different grades of 'Meprol' for different requirements and purposes.

WORLD CROP REPORTS

EGYPT

Cotton production. There are indications that the Egyptian Government is having some success in its efforts to encourage transfer of land from cotton to grain production. The International Federation of Agricultural Producers says the latest cotton crop estimate for Egypt places this season's total ginned crop at under 6 million kantars, equal to roughly 300,000 tons. This is a decrease of almost 40% compared with the previous year.

The Government of Egypt has been urging farmers to change from cotton growing to grain production, and observers believe the decrease indicates that the transfer programme is meeting some success.

AUSTRALIA

Wheat prospects. Australia's 1953-54 wheat crop is expected to be smaller than it was the previous year. Latest figures indicate a production of about 160 million bushels compared with 193 million. A crop of the size indicated would provide Australia with about 80 million bushels available for export. This supply would provide Australia with enough wheat to fill its International Wheat Agreement commitment, with some wheat left over for sale outside the Agreement.

Sugar prospects. The record crop of 1,230,000 tons raw sugar is expected to be obtained from the 8½ million tons of cane being harvested towards the end of 1953. This quantity is over 30% better than the previous record established in the 1952 season.

Figures of Australian production of raw sugar are given as under:—

Season	*Tons*
1949	909,700
1950	896,800
1951	725,300
1952	916,600
1953 (estimated) ..	1,230,000

In Queensland favourable weather conditions throughout the growing period, together with greatly increased areas under cane, resulted in record tonnages in all districts. Most of the mills achieved an increased rate of work, although their factory expansion programmes are, in many cases, still incomplete.

In New South Wales there has been a recovery to about 75% of normal from the disastrously low output of 1952. Satisfactory planting has been made and there are reasonable grounds to expect that production should return to the normal of 40,000 tons.

Sugar production in New South Wales over the last five years is as under:—

Season	*Tons*
1949	39,500
1950	40,000
1951	40,000
1952	13,900
1953 (estimated) ..	32,000

The Colonial Sugar Refining Company's total sales of sugars and syrups in Australia for the year ended September 30, 1953 were 420,000 tons, about 17% less than the preceding year. One factor contributing to the fall in volume of sales was the building up of stocks by purchasers prior to the refined sugar price increases in 1952 and the subsequent reduction of those stocks. Another important factor is the loss of some parts of the export market for foods containing sugar and ' sugar in disguise.'

(*From Czarnikow's ' Sugar Review.*')

PAKISTAN

Tea crop. The final forecast of the area under tea for the year 1953-54 is 75,000 acres as against 73,000 acres, which was the actual area under the crop in the previous year. This shows an increase of 2.7%. This increase is due to new cultivation in certain gardens of the district of Chittagong and Sylhet.

The yield of this crop for the year 1953-54 is estimated at 52 million lb. as against 54 million lb. reported in the corresponding forecast of the previous year, and shows a decrease of 3.7%. The actual production for the year 1952-53 is reported as 51 million lb.

ISRAEL

Olive cultivation. 1,700 to 1,900 tons of oil were expected to be produced from olives in 1953, Mr. Zalman Rappaport, head of the Fruit and Grape Growing Division of the Ministry of Agriculture, stated recently. All the oil, except for 150 tons, is to be for domestic use and is to be distributed by the Ministry of Commerce and Industry.

The season for picking olives, pickling them for eating purposes, or processing them for their oil, runs from the end of August to the beginning of January, extending longer in the hill regions. At present there are about 137,000-140,000 dunams of olives under cultivation in Israel. Of this area, 60,000 dunams are cultivated by the Arab inhabitants and 30,000 by the Matae Ha'uma (Government Plantations Ltd), while Kibbutzim, Moshavim, and individual Jewish farmers, are caring for 30,000-32,000 dunams, of which 23,000-25,000 dunams have been allotted them by the Custodian of Abandoned Property. The remaining area is controlled by the Custodian of Abandoned Property and is used as sites for military bases or contains groves in such poor condition that they are not cultivated.

Of the 7,000 dunams of olive groves that Jewish farmers have been cultivating since before the founding of the State, half are irrigated and are planted with pickling olives, which cannot be used for oil.

It is difficult to persuade Jewish farmers to raise olives for oil, since the costs are high, and the Government fixed price, which is based on the world market price, does not cover their expenses. Last year the Government paid IL.700 for a ton of olive oil; it requires at least 4 tons of olives at IL.250 to make 1 ton of oil. This, it is estimated, covered about 75% of the cost for the Jewish farmer. This year the Government is paying IL.900, still hardly sufficient to cover the expenses of the Jewish farmer. On the other hand, the Arab farmer, who uses his whole family to care for and harvest his crop and who keeps most of the oil for his own consumption, finds it even profitable to continue growing olives at the present price.

Asked what steps the Government is taking to encourage an increase in the amount of olives being cultivated for oil, Mr. Rappaport said that demonstrators were visiting the Kibbutzim and Jewish and Arab settlements to point out methods by which productivity could be raised. It is believed that with proper cultivation and pruning, the yield per dunam could be doubled from 60 kg. to 120 kg. within five years. With irrigation, the yield per dunam for oil olives could be raised to 600-800 kg., Mr. Rappaport stated. Loans to improve machinery and conditions are being offered by the Government to encourage increased olive oil production. Subsidies are being given to new settlements, depending on the amount of oil olives they plant. If the amount under cultivation is increased substantially, there are plans to export up to a third of the produce.

The oil olives expected to be produced this season will supply less than 6% of the 30,000 tons of oil and fats required by the population. Much of the deficit is made up by oil seeds such as peanut and sesame, which are not valued as highly as olive oil, while some is imported.

(*Jewish Agency.*)